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REVIEW DRAFT TECHNICAL MANUAL

for

SPECTRUM ANALYZER TS-2332/WLR-6(V)
(SPECTRUM DISPLAY UNIT)

DEPARTMENT OF THE NAVY

NAVAL SHIP SYSTEMS COMMAND

B256

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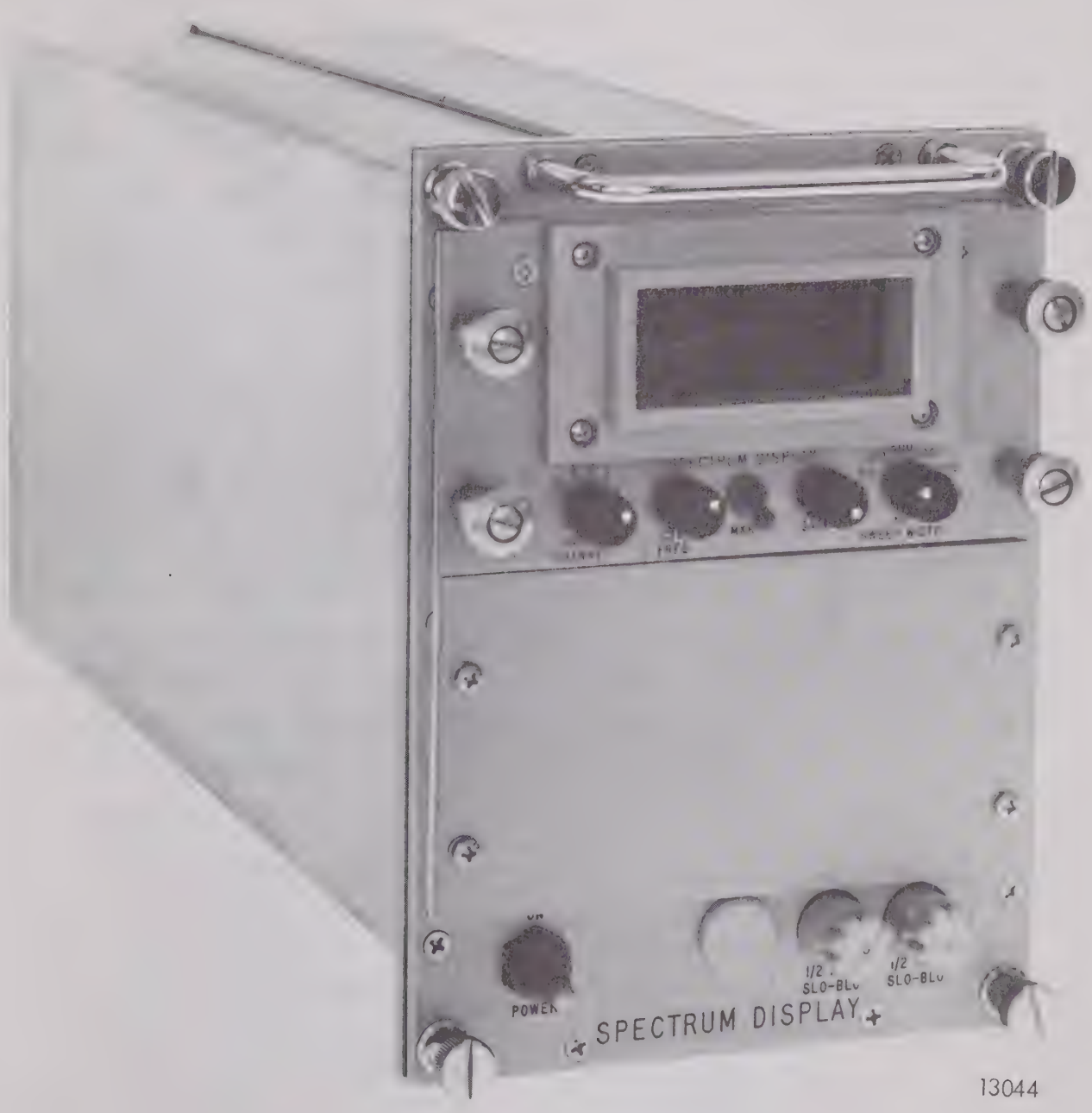


Figure 1-1. Spectrum Analyzer TS-2332/WLR-6(V)

SECTION 1

GENERAL INFORMATION

1-1. SCOPE.

1-2. This technical manual covers general information, installation, operation, trouble-shooting, and maintenance instructions for Spectrum Analyzer, TS-2332/WLR-6(V) (Spectrum Display Unit), and is in effect upon receipt. Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications.

1-3. GENERAL DESCRIPTION.

1-4. The spectrum display unit (SDU) (figure 1-1) is a self-contained, transistorized unit capable of displaying on a cathode-ray tube (CRT) the separate frequency components that comprise the spectrum of 21.4 Mc receiver IF outputs. This displayed spectrum can be used as a receiver tuning aid when searching for signal activity or to analyze the modulation characteristics of the input signal.

1-5. Any one of six separate inputs can be selected for display on one of the five available sweep widths of 50 kc, 100 kc, 500 kc, 1000 kc, and 2000 kc. An accurate 21.4 Mc marker can be selected and displayed for use as a frequency reference and as a means of locating the center of the SDU passband.

1-6. REFERENCE DATA.

a.	Primary Power Requirements:	115 vac, 60 cps, single phase, 30 watts
b.	No. of Inputs:	6, switch selectable
c.	Input Impedance:	50 ohms
d.	Input Center Frequency:	21.4 Mc
e.	Input Bandwidth:	2 Mc ±10%
f.	Center Frequency Control Range:	±20% of sweep width
g.	Input VSWR:	2:1 maximum
h.	Input Cross Talk:	60 db minimum
i.	Sensitivity:	10 microvolts maximum for one inch vertical deflection
j.	Image Frequency Rejection:	60 db minimum
k.	IF Rejection:	60 db minimum

l.	Rejection of All Other Spurious Signals (including those internally generated):	60 db minimum
m.	RFI Radiation of All Spurious Signals (including local oscillator and crystal marker):	10 microvolts maximum, measured at input terminal terminated in 50 ohms.
n.	Sweep Width:	50 kc, 100 kc, 500 kc, 1000 kc, and 2000 kc; switch selectable
o.	Sweep Rate:	30 sweeps per second ±20%
p.	Sweep Linearity:	5% of total sweep width
q.	Resolution (separation of two CW signals with a 6 db valley between):	3 kc maximum when using 50 kc sweep width: 15 kc maximum for all higher sweep widths.
r.	Frequency vs. Amplitude Variations:	±1-1/2 db for a CW signal tuned across maximum sweep width.
s.	Amplitude Scales:	A signal 20 db down from a signal that produces 100% vertical deflection produces a vertical deflection of at least 10%.
t.	Gain Control Range:	60 db minimum
u.	Crystal Marker:	21.4 Mc ±0.01%
v.	Operating Temperature Range:	0°C to +55°C
w.	Storage Temperature Range:	-45°C to +75°C

1-7. EQUIPMENT SUPPLIED.

1-8. Table 1-1 lists the equipment supplied.

1-9. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED.

1-10. Table 1-2 lists the equipment and publications required but not supplied.

TABLE 1-1. EQUIPMENT SUPPLIED

QTY PER EQUIP	NAME	OVERALL DIMENSIONS			VOLUME (CU FT)	WEIGHT (LB)
		HEIGHT (IN.)	WIDTH (IN.)	DEPTH (IN.)		
1	Spectrum Analyzer TS-2332/WLR-6(V)	8.719	6.312	15.677	0.5	25
2	Technical Manual, NAVSHIPS 0967-207-3320, Spectrum Analyzer, TS-2332/WLR-6(V)	11.0	8.5	-	-	-

TABLE 1-2. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE	EQUIPMENT CHARACTERISTICS
	NAME	DESIGNATION		
1	Sweep Generator	Telonic SM-2000 with SH-1 plug-in oscillator	Trouble-shooting and maintenance	Sweep width: greater than 2 Mc Center frequency: 21.4 Mc
1	X-Y Oscilloscope	CBTV-503	Trouble-shooting and maintenance	Capable of x-y presentation. Vertical sensitivity: 2 mv/cm Horizontal sensitivity: 1 v/cm Sweep speed: 0.5 μs/cm
1	HF Signal Generator	CAQI-606A	Trouble-shooting and maintenance	Modulation: CW and AM Frequency: 20-23 Mc Frequency accuracy: ±1% Output level: 10 microvolts to 3 volts Output accuracy: ±1 db Output impedance: 50 ohms

TABLE 1-2. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED (Cont)

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE	EQUIPMENT CHARACTERISTICS
	NAME	DESIGNATION		
1	Test Oscillator	CAQI-651A	Trouble-shooting and maintenance	Frequency: 25 kc to 1 Mc Frequency accuracy: ±2% Output level: 3 volts rms into 50 ohms
1	Electronic Voltmeter	CAQI-410C	Trouble-shooting and maintenance	Voltage range: 100 mv to 1500 volts Accuracy: ±2% Input Impedance: at least 11 megohms
1	VOM	CSV-260	Trouble-shooting	AC voltage range: 6 to 550 vac
1	Output Termination	CAQI-11507A	Trouble-shooting and maintenance	Impedance: 50 ohms Attenuation: 20 db
1	RF Millivoltmeter	CAQI-411A	Trouble-shooting	Input Impedance: at least 200 K ohms Voltage: 10 mv full scale Accuracy: ±3% Frequency: 21.4 Mc

SECTION 2

INSTALLATION

2-1. SCOPE.

2-2. This section contains instructions for installing the spectrum display unit (SDU).

2-3. POWER REQUIREMENTS.

2-4. The spectrum display unit (SDU) requires a 115 vac, 60 cps single phase primary power source and consumes approximately 30 watts. See figure 5-14 for the primary power distribution diagram.

2-5. INSTALLATION.

2-6. The spectrum display unit (SDU) is a self-contained, rack-mounted unit secured by four captive screws at the corners of the front panel. Connectors on the rear panel of the unit mate automatically with captive receptacles when the unit is inserted in the rack. The connector pin locations and functions are given in figure 2-1, and table 2-1 respectively. Figure 2-2 is an outline drawing of the SDU showing the dimensions and clearances required for installation.

TABLE 2-1. CONNECTOR PIN FUNCTIONS

CONNECTOR AND PIN NO.	FUNCTION	WIRE/ CABLE TYPE	AWG NO.
P1-1	No. 1 IF input	621146 coax.	--
-2	No. 2 IF input	621146 coax.	--
-3	No. 3 IF input	621146 coax.	--
-4	No connection	--	--
-5	115 vac input	Shielded, twisted pair	20
-13	115 vac input		
-6	Shield ground	Unshielded	16
-14	Chassis ground	Unshielded	16
-7 thru -12 and -15 thru -20	No connection	--	--
P3-1	No connection	--	--
-2	No connection	--	--
P4-1	No. 4 IF input	621146 coax.	--
-2	No. 5 IF input	621146 coax.	--
-3	No. 6 IF input	621146 coax.	--
-6	Shield ground	Unshielded	16
-14	Chassis ground	Unshielded	16
-4 and -5, -7 thru -13, and -15 thru -20	No connection	--	--

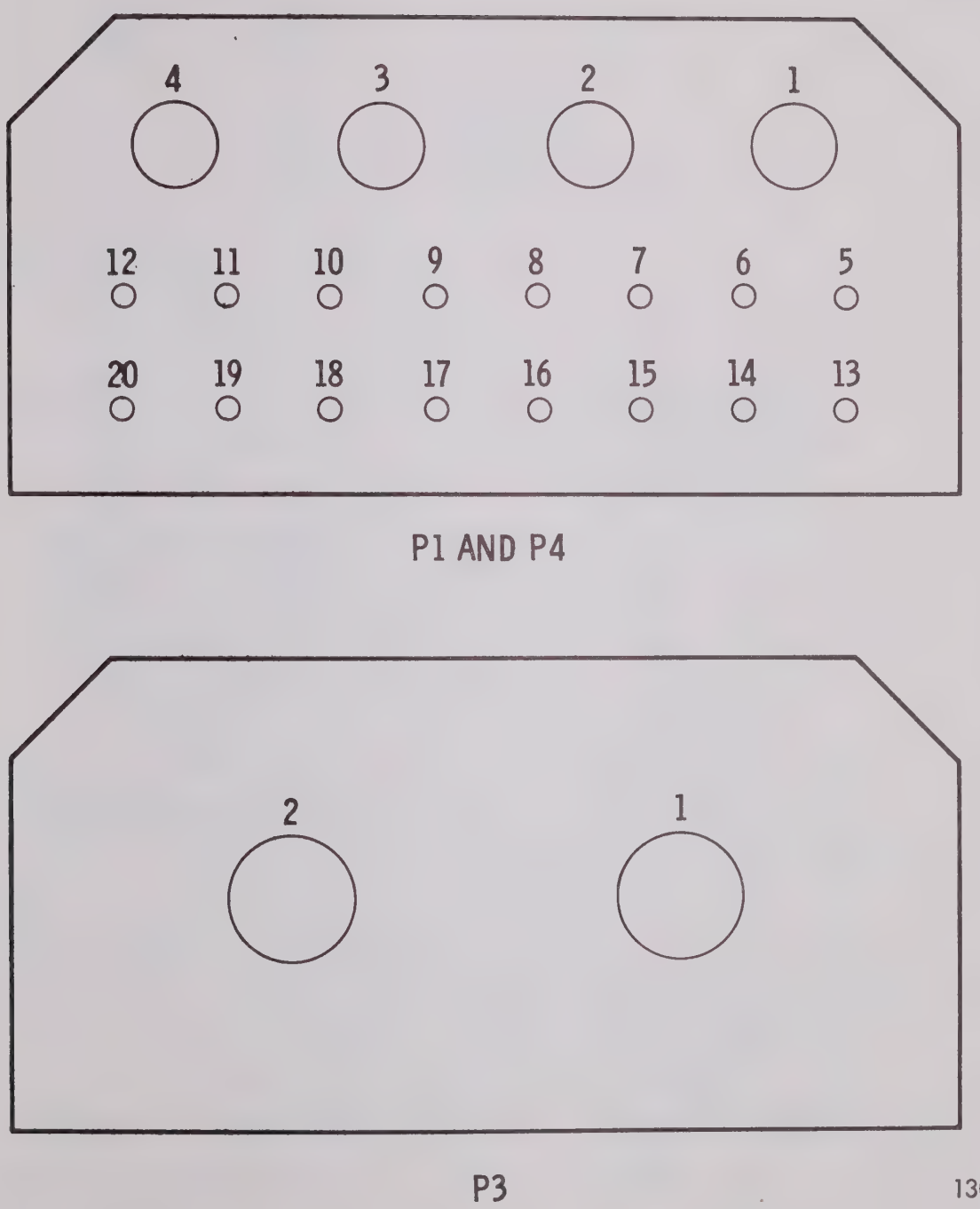


Figure 2-1. Connector Pin Locations

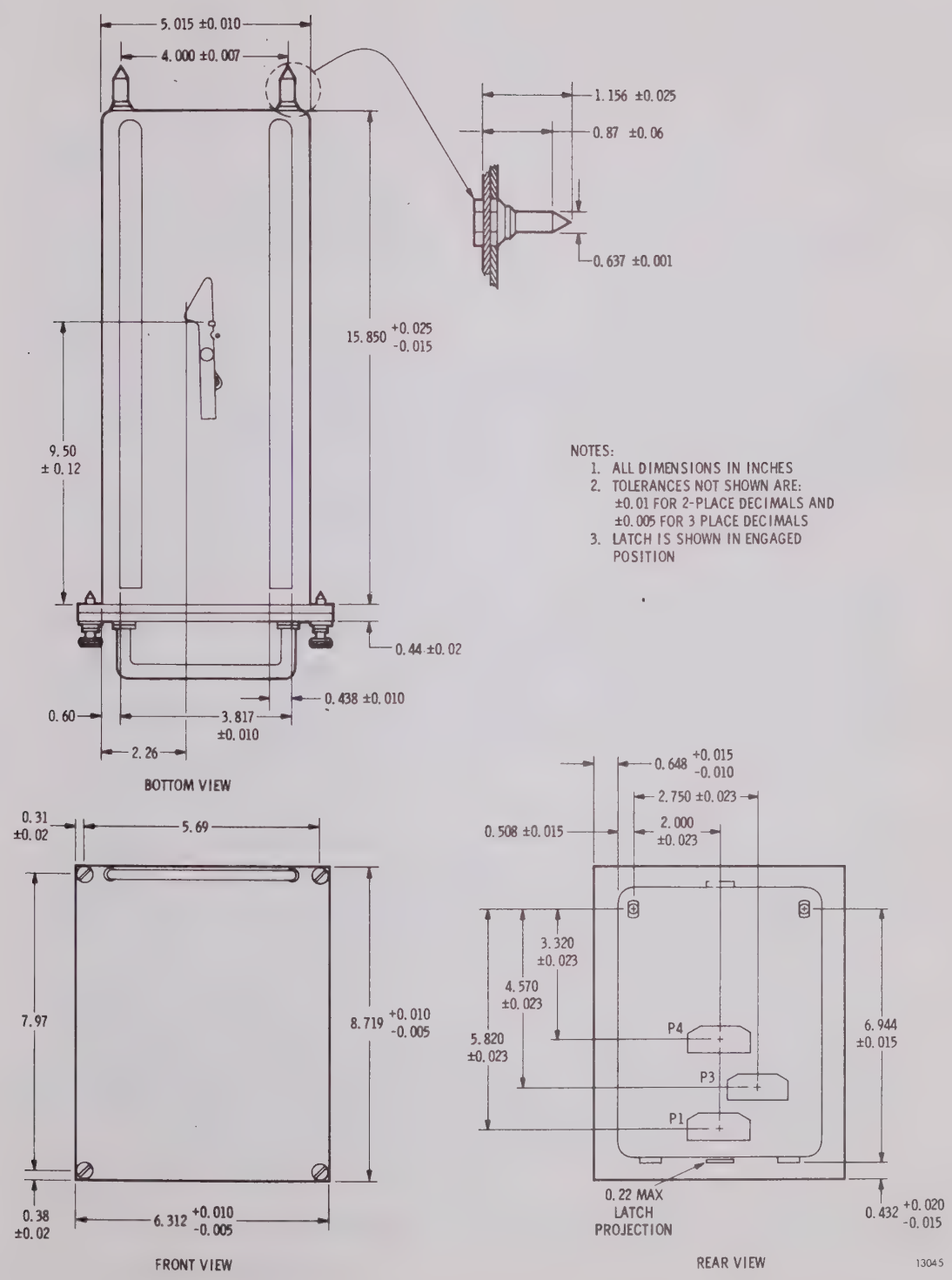


Figure 2-2. Spectrum Display Unit Outline Drawing

SECTION 3

OPERATION

3-1. SCOPE.

3-2. This section covers functional operation, operating procedures, and operator maintenance.

3-3. FUNCTIONAL OPERATION.

3-4. The spectrum display unit (SDU) is capable of displaying on a CRT the separate frequency components of an input signal centered at 21.4 Mc. The display can be used as a receiver tuning aid when searching for signal activity or to analyze the spectrum of the input signal. The distribution and relative amplitudes of the frequency components can be used to study the modulation characteristics of the received signal.

3-5. A front panel INPUT CHANNEL selector switch selects one of six separate inputs to be displayed. Five sweep widths centered at 21.4 Mc and ranging from 50 kc to 2000 kc are provided. A center frequency control positions the displayed spectrum horizontally on the CRT. The range of this control is ±20% of the selected sweep width. A 21.4 Mc reference marker is displayed by the MKR switch. The vertical deflection of the displayed spectrum is controlled with a gain control.

3-6. CRT face-plate markings consist of a vertical center line with four equal divisions and 11 evenly spaced unit marks on a horizontal line. Because the selected sweep width is swept at a linear rate, the horizontal marks can be used to estimate the frequency of the displayed components.

3-7. OPERATING PROCEDURES.

3-8. The operating procedures consist of a description of operating controls, a sequence of operation, display presentations, and a summary of operating procedures.

3-9. DESCRIPTION OF OPERATING CONTROLS.

3-10. Descriptions of the operating controls shown in figure 3-1 are listed in table 3-1.

3-11. SEQUENCE OF OPERATION.

3-12. The following paragraphs contain step-by-step instructions for operating the spectrum display unit (SDU).

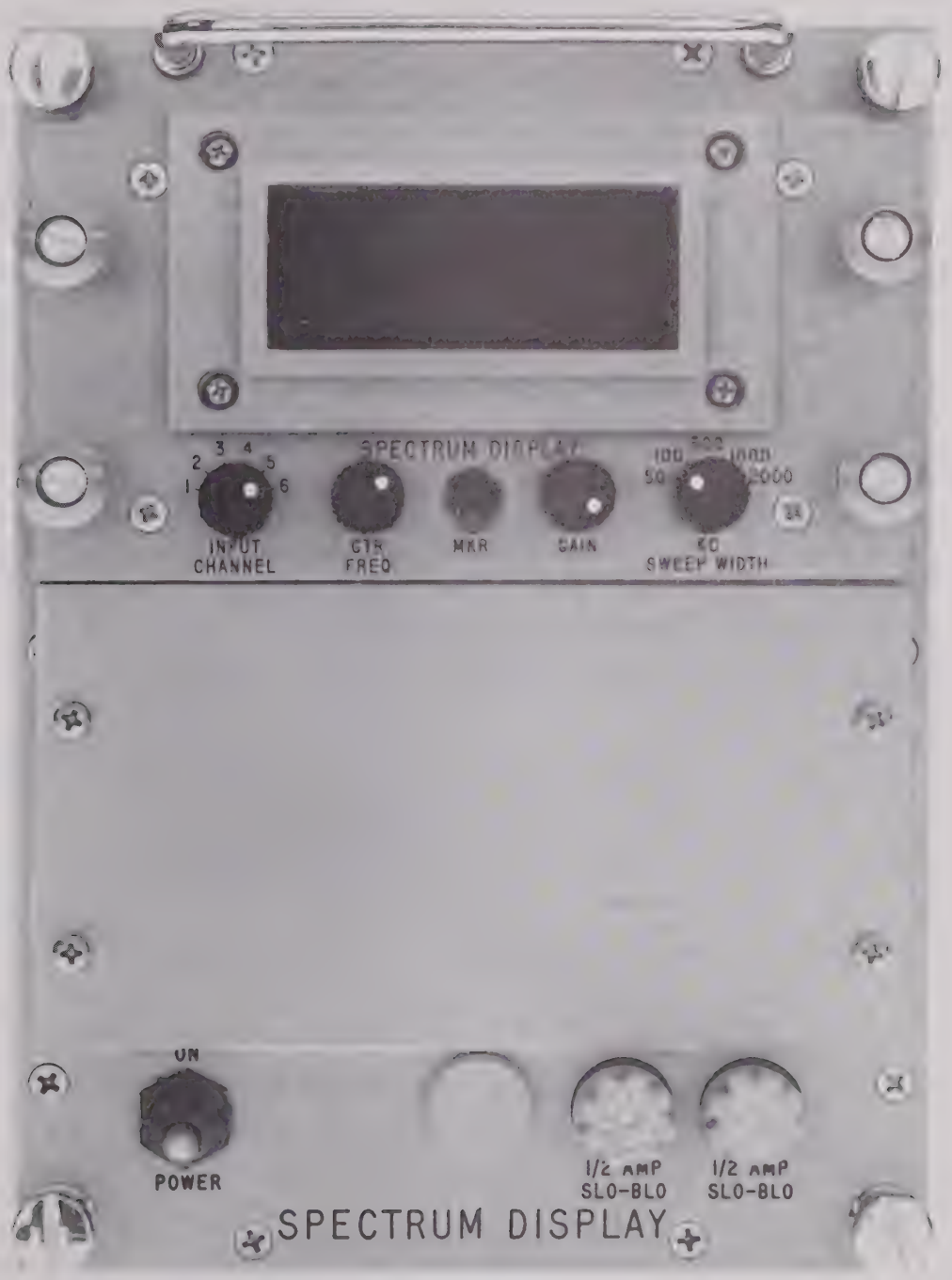


Figure 3-1. Spectrum Analyzer TS-2332/WLR-6(V) (Spectrum Display Unit) Operating Controls

TABLE 3-1. OPERATING CONTROLS

CONTROL OR INDICATOR	FUNCTION
POWER switch	In ON position, applies primary ac power to unit.
1/2 AMP SLO-BLO fuses	Protect primary ac power source and SDU.
INPUT CHANNEL selector	Selects one of six inputs to be displayed on CRT.
KC SWEEP WIDTH selector switch	Selects one of five sweep widths (calibrated in kc) that will be centered at 21.4 Mc and occupy the full horizontal width of CRT. For example, with a selected sweep width of 2000 KC, the frequency limits of the CRT display are 20.4 Mc on the right and 22.4 Mc on the left.
CTR FREQ control	Moves displayed spectrum left or right on CRT so that spectrum can be centered under vertical line on CRT face plate. Range of control is ±20% of selected sweep width.
MKR switch	When placed in up position, a vertical deflection representing 21.4 Mc is displayed on CRT.
GAIN control	Varies amplitude of displayed spectrum.

3-13. Preliminary Procedure.

a. Set POWER switch to ON.

b. Set GAIN control to mid-range.

3-14. Operation.

a. Set INPUT CHANNEL switch as desired.

b. Set KC SWEEP WIDTH switch to 2000.

c. Set MKR switch to up position.

d. Adjust CTR FREQ control so that marker frequency line is positioned under vertical line on CRT face plate.

e. Set MRK switch to down position.

f. Set GAIN control so that tallest spectrol line fills CRT.

g. Set KC SWEEP WIDTH switch as desired. The lower sweep widths display less of the total spectrum, but display it in greater detail.

3-15. DISPLAY PRESENTATIONS.

3-16. Typical spectrum display presentations are shown in figure 3-2. Single-tone modulating signals only are shown; complex modulating signals such as voice, will generate many more sidebands and spectrol lines. If more detailed information on the techniques of spectrum analysis is desired, refer to an appropriate text.

3-17. SUMMARY OF OPERATING PROCEDURES.

3-18. Table 3-2 contains a summary of operating procedures.

3-19. OPERATOR MAINTENANCE.

3-20. EMERGENCY MAINTENANCE.

3-21. Emergency maintenance for the spectrum display unit (SDU) is limited to replacing blown fuses. The two equipment fuses are mounted on the front panel of the unit. When replacing blown fuses, ensure that the replacement units are of the same physical and electrical sizes as those being replaced.

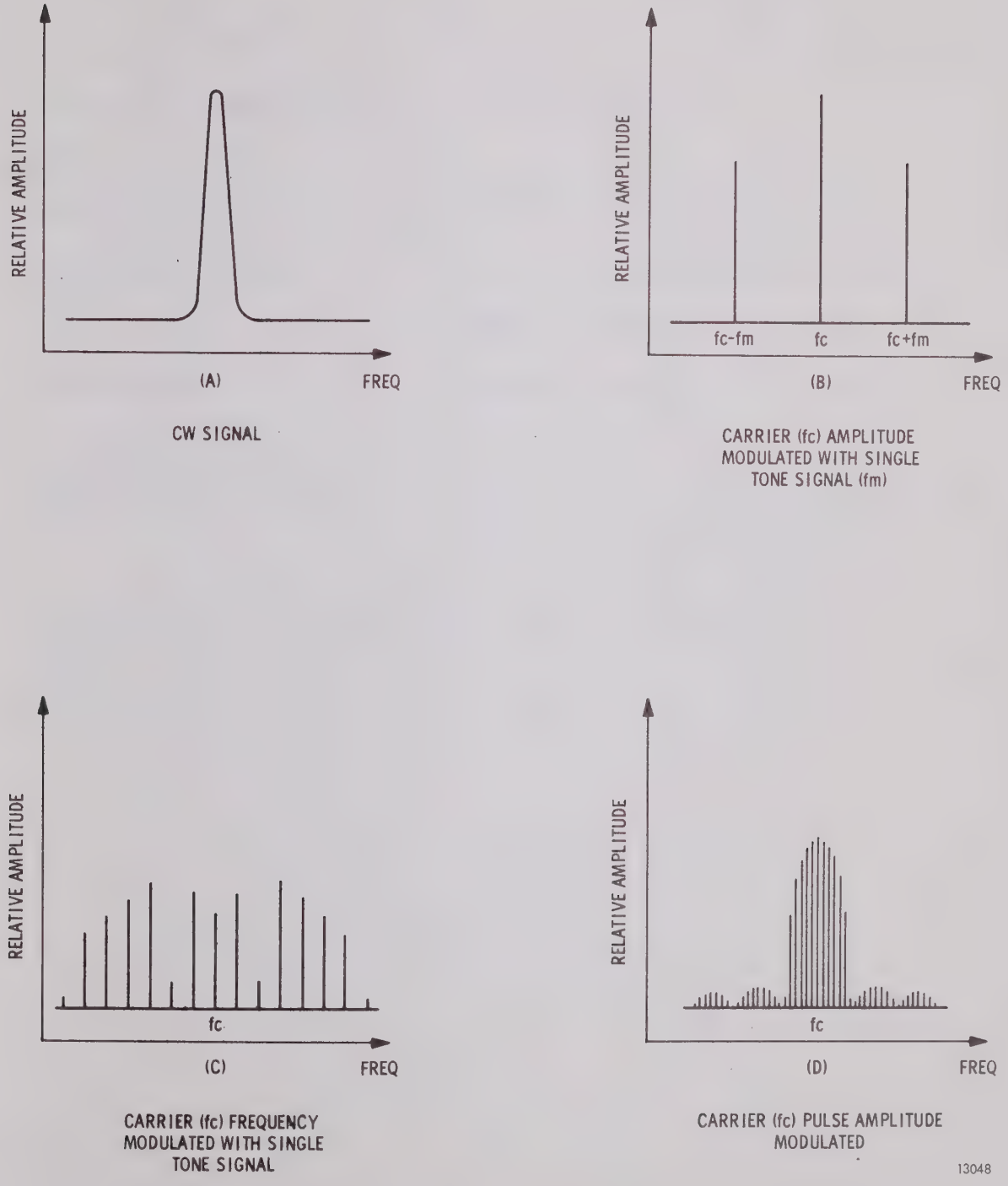


Figure 3-2. Spectrum Display Unit, Typical Presentations

TABLE 3-2. SUMMARY OF OPERATING PROCEDURES

STEP	PROCEDURE
1. Initial Control Settings	CRT FREQ and GAIN controls set to mid-range.
2. Energizing the Spectrum Display Unit	Set POWER switch to ON.
3. Input Channel Selection	Set INPUT CHANNEL switch as desired.
4. Sweep Width Selection	Set KC SWEEP WIDTH switch to position that displays desired width of spectrum.
5. Marker Selection	To display a spectral line at 21.4 Mc, set MKR switch to up position.
6. Center Frequency Adjustment	Set MKR switch to up position and adjust CTR FREQ control to position 21.4 Mc spectral line under vertical line on CRT face plate.
7. Securing the Spectrum Display Unit	Set POWER switch to down position.

SECTION 4

TROUBLESHOOTING

4-1. SCOPE.

4-2. This section contains a general discussion of logical troubleshooting, an overall functional description, circuit descriptions and test data for the spectrum display unit.

4-3. LOGICAL TROUBLESHOOTING.

4-4. Before troubleshooting any equipment, review the following six logical troubleshooting steps.

a. SYMPTOM RECOGNITION. The first step in the troubleshooting procedure is based on complete knowledge and understanding of equipment operating characteristics. Since all equipment troubles are not the direct result of component failures, certain troubles causing less than peak performance may not be apparent. This type of equipment trouble is usually discovered while running the performance tests in section 5. It is important that the not-so-apparent troubles as well as the apparent troubles be recognized.

b. SYMPTOM ELABORATION. After an equipment trouble has been recognized, all the available aids designed into the equipment should be used to identify the source of the original trouble. Front panel controls and built-in indicating or testing aids should be used to provide better identification of the symptom. Proper setting of operating controls may eliminate the trouble.

c. LISTING PROBABLE FAULTY FUNCTION. Formulate a number of logical choices as to the cause and likely location (functional unit, functional section, functional circuit group, or module) of the trouble. The logical choices are based on an operating knowledge of the equipment, a full identification of the trouble symptom, and information contained in this manual. The overall functional description and its associated block diagram should be referred to when selecting possible locations of the fault.

d. LOCALIZING THE FAULTY FUNCTION. Equipment should be checked in accordance with the overall test data and the associated checkout and trouble isolation procedure. As aids in this process, the manual contains an overall functional description and a functional or servicing block diagram showing each functional section, functional circuit group, or module. Waveforms (or other pertinent indications) are also included at significant check points on the block diagram to aid in isolating the fault. In addition, test data (such as information on

control settings, critical adjustments, and test equipment required) are supplied to augment the functional description and block diagrams.

e. LOCALIZING TROUBLE TO THE CIRCUIT. Determine which circuit or component is defective. Servicing block diagrams for each functional circuit group or module provide the signal flow and test point location information needed to isolate the faulty circuit. Circuit descriptions, simplified schematic diagrams or references to complete schematic diagrams in section 5 and pertinent test data for each functional circuit or module are included to help isolate the faulty circuit.

f. FAILURE ANALYSIS. After the trouble (faulty component, misalignment, etc) has been located (but prior to performing corrective action), the procedure followed up to this point should be reviewed. This review is necessary to make certain that the fault discovered is actually the cause and not just the result of the malfunction.

4-5. OVERALL FUNCTIONAL DESCRIPTION.

4-6. The spectrum display unit (SDU) processes the 21.4 Mc IF outputs (with up to ±1 Mc side bands), from radio frequency receivers and displays the individual frequency components on a CRT. The relative amplitude versus frequency display seen on the CRT represents the frequency spectrum of the signal. See figure 4-4 for the functional block diagram of the SDU.

4-7. All operating voltages for the circuit boards are generated in the low-voltage, regulated power supply and the required high voltages for the CRT are generated in the high-voltage power supply.

4-8. The SDU is functionally a double-conversion, superheterodyne receiver using a swept first local oscillator. The six 21.4 Mc inputs are applied to diode gates which provide isolation to reduce interchannel cross talk. One gate at a time is enabled by the voltage selected by the six sections of the INPUT CHANNEL switch. The selected input is then applied to an input amplifier and bandpass filter to limit the bandwidth of the input to 21.4 Mc ±1 Mc. The gain of the entire unit is controlled at this point by the GAIN control.

4-9. The first conversion takes place in the first mixer by mixing the 21.4 Mc input and its ±1 Mc side bands with the output of the swept first local oscillator. The center frequency of the first local oscillator is 25.7 Mc and five sweep widths ranging from 50 kc to 2 Mc can be selected by the KC SWEEP WIDTH switch. Sweeping of the first local oscillator is accomplished by driving the oscillator with a ramp waveform derived in the sweep generator. Any time a frequency component of the input signal and the instantaneous frequency of the first local oscillator produces a difference of 4.3 Mc an output is passed to the first IF amplifier.

The sequential total of all 4.3 Mc differences (along with relative amplitudes) during the sweep width of the local oscillator is the frequency spectrum of the input signal. The center frequency of the first local oscillator can be varied over a narrow range with the CRT FREQ control; this allows the displayed spectrum to be centered under the vertical graticule line on the CRT face plate.

4-10. A marker oscillator provides an accurate reference spectral line which corresponds to 21.4 MC. When the MKR switch is closed, the 30 Mc output of the marker oscillator beats with the 25.7 Mc center frequency of the first local oscillator to produce a 4.3 Mc mixer output.

4-11. The first mixer output is amplified in the first IF amplifier and applied to the second mixer. A fixed 4.755 Mc output of the second local oscillator is mixed with the 4.3 Mc input to produce a difference frequency of 455 kc.

4-12. The second mixer output is applied to either a high- or low-resolution filter to improve the visual ability to discriminate between adjacent spectral lines which are close together in frequency. Further amplification is provided by a second IF amplifier to drive the push-pull envelope detector. This envelope, or peak detector, rectifies the 455 kc making up each spectral line and filters remove the 455 kc IF component to produce the envelope of the individual spectral lines. As seen in figure 4-1, the individual spectral lines are actually the envelope formed by narrow bursts of the 455 kc IF. The width of the lines is exaggerated to show the 455 kc component and the lower half of the waveform is not shown.

4-13. The sweep generator provides a push-pull sawtooth waveform to drive the horizontal deflection plates of the CRT. The sawtooth is also used to sweep the first local oscillator. This action synchronizes the CRT sweep and the oscillator sweep so that the CRT base line is a function of frequency.

4-14. POWER SUPPLY ASSEMBLY (A1) CIRCUIT DESCRIPTION.

4-15. The power supply assembly consists of diode rectifier assembly A1A2, filter networks and voltage regulator assembly A1A1. See figure 5-15.

4-16. DIODE RECTIFIERS AND FILTER NETWORKS.

4-17. The two center-tapped secondaries of transformer T1 supply the ac voltage to the full-wave rectifiers. Diodes CR1 and CR3 are the -175-volt rectifiers while L1, C1 and R1 form the filter network. The +175 volts is supplied by diodes CR2 and CR4 and the filter consists of C2 and R2. Diodes CR5 and CR7 furnish -40 volts and C3 and R3 form the filter. The +40 volts is furnished by diodes CR6 and CR8 and the filter consists of C4 and R4.

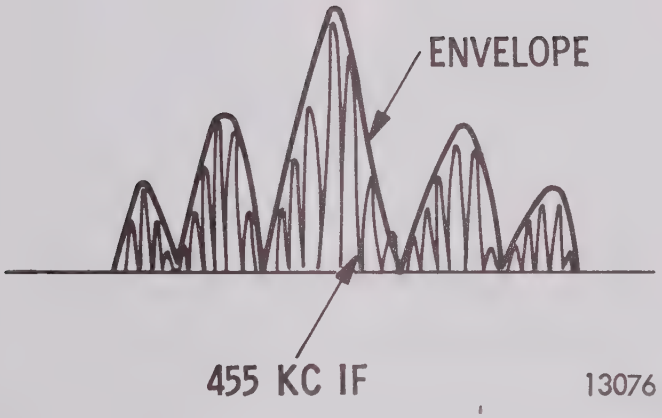


Figure 4-1. Composition of Spectral Lines

4-18. VOLTAGE REGULATOR.

4-19. See figure 4-5 for the servicing block diagram and figure 5-17 for the schematic diagram. The voltage regulator assembly consists of four, series-type voltage regulators that furnish output voltages of -148 volts, -100 volts, +150 volts, -25 volts and +25 volts.

4-20. +150-Volt Regulator.

4-21. This circuit consists of current limiter Q5, preregulator Q6, series regulator Q7 and sensor/amplifier Q8-Q9. A sample of the +150-volt output is taken across divider network R15 through R17 and applied to Q8, one-half of a differential amplifier. The input to Q9, the other half of the differential amplifier, is the voltage developed by voltage regulator V1. Any difference between these two inputs is amplified and applied to Q7 to correct the output voltage. Preregulator Q6 is connected as a constant current source, which acts as a very large incremental or ac impedance. This raises the effective voltage gain of the differential amplifier and improves output voltage regulation. It also reduces the input ripple at the base of transistor Q7 and results in a much lower ripple on the regulated output.

4-22. Transistor Q5 limits the load current to a safe level in the following manner: The base-emitter bias of transistor Q5 is determined by the voltage drop across resistor R10 and the breakdown voltage of diode CR9. With normal load currents, the drop across R10 is such that Q5 is conducting. When the load current reaches a predetermined level, the drop across R10 reverse biases Q5 and tends to cut it off. Cutoff is not quite reached, however, and the load current is limited to that level which just keeps Q5 from being cut off.

4-23. ±25-Volt Regulators.

4-24. These two regulators are identical in design and function and are emitter follower type regulators with preregulated inputs. The preregulator is used to reduce the output ripple, as explained in paragraph 4-21. As an example of their operation, consider the -25-volt circuit. Zener diode CR13 provides a constant input voltage to Q11, which is connected as an emitter follower to give the low output impedance required for load regulation.

4-25. -148-Volt and -100-Volt Regulators.

4-26. These circuits are not used.

4-27. DISPLAY ASSEMBLY (A2) CIRCUIT DESCRIPTION.

4-28. See figure 4-5 for the servicing block diagram and figure 5-16 for the interconnection diagram. The display assembly is comprised of six diode gates, a high-voltage power supply,

a CRT, and four plug-in subassemblies. The subassemblies are input amplifier A2A1, IF amplifier and sweep oscillator A2A2, control potentiometer A2A3, and sweep generator A2A4.

4-29. DIODE GATES.

4-30. The six IF inputs are applied to the gates via pins A1 through A5 of connector P2 and A1 of connector P1. All six gates are identical, so only the operations of input gate number one is discussed. With INPUT CHANNEL switch S1-A in the number one position, diode gate CR3 is forward-biased by the -12 volts applied through R18 and the input signal is passed to input amplifier A2A1 pin 1 through C17. All other gates have no bias and the diodes act as a high impedance in series with the capacitance formed by the open switch contacts. This reduces the cross talk, or channel interaction, between the selected and unselected inputs.

4-31. HIGH-VOLTAGE POWER SUPPLY.

4-32. The 115 vac input at pins 8 and 9 of connector P2 is applied to the primary of transformer T1. A stepped-up voltage at transformer secondary pins 5 and 6 is then applied to voltage doubler CR1, CR2, C7A, and C7B. This voltage doubler output is regulated by regulator VR1 to -1200 volts, which is applied to control potentiometer A2A3.

4-33. INPUT AMPLIFIER (A2A1) CIRCUIT DESCRIPTION.

4-34. See figure 5-18 for the schematic diagram of input amplifier A2A1. A 50-ohm impedance match is provided by Pi network R1, R2, and R3 and is coupled by C1 to an LC bandpass filter. The LC filter circuit contains variable inductances L1 through L6 and capacitors C2 through C12. Coupling within the filter is provided by capacitors C2, C5, C7, C9, and C11. The filter has a passband of 2 Mc, with 1 db points at 20.4 and 22.4 Mc.

4-35. Input amplifier transistors Q1 and Q2 are connected in cascode and provide high gain, low noise, and excellent stability characteristics. Components C12, C13, and R4 provide an impedance match between the output of the LC filter and the base circuit of amplifier Q1. Base bias for transistor amplifier Q1 is determined by the current through R5 which is controlled by the front panel GAIN control. The collector of Q1 is coupled by C18 to the emitter of grounded base amplifier Q2. The collector circuit of transistor Q2 includes a double-tuned network. Inductor L7 and capacitor C19 form one network and C20 couples the signal to the second network consisting of L8 and capacitors C21 and C23. Resistor R8 loads the first tuned network to provide the required bandwidth. The signal is applied to the base of transistor amplifier Q3, which is connected in cascode with Q4. The collector circuit of Q4 also contains a double-tuned network similar to the one in the collector circuit of Q2. A Pi network made up of resistors R23, R24, and R25 provide tuned circuit loading and 10 db of

output signal attenuation. The output signal is coupled by C33 to XA1 pin 14 for distribution to IF amplifier and sweep oscillator board A2A2.

4-36. IF AMPLIFIER AND SWEEP OSCILLATOR (A2A2) CIRCUIT DESCRIPTION.

4-37. See figure 5-19 for the schematic diagram of the IF amplifier and sweep oscillator.

4-38. First Mixer.

4-39. The first mixer consists of cascode-connected transistors Q1 and Q2. These two transistors are direct coupled to each other and the bias for the pair is set by resistors R1 and R2 in the base of Q1 and by emitter resistor R3. Transistor Q1 is connected in the common emitter configuration while transistor Q2 is connected in the common base configuration. Inputs to the mixer, from input amplifier board A2A1 and swept local oscillator Q8, are applied to the base of Q1. Mixing action takes place in the emitter-base junction of Q1. The resulting frequency is amplified by Q2 and applied to a 4.3 Mc doubled-tuned network. One tuned circuit of the network consists of L1 and C3 and is coupled to the second tuned circuit by C5. The second tuned circuit consists of L2 and capacitors C6 and C7. The tuned network is resonant at 4.3 Mc and rejects the 21.4 and 25.7 Mc signals present at the input of the mixer. Variable inductors L1 and L2 permit a 4.3 Mc center frequency alignment with a 3 db bandwidth of 100 kc.

4-40. 4.3 Mc IF Amplifier.

4-41. Transistors Q3 and Q4, connected in cascode, comprise the 4.3 Mc IF amplifier stage. Resistor R9 is a gain adjustment. The output of Q4 is applied across a double-tuned network and then applied to second mixer Q5. This double-tuned network is similar to that between the first mixer and the 4.3 Mc IF amplifier.

4-42. Second Local Oscillator and Mixer.

4-43. Crystal oscillator Q6 and second mixer Q5 convert the 4.3 Mc IF to a final IF of 455 kc. Oscillator Q6, operating at a frequency of 4.755 Mc, is controlled by crystal Y1. Resistors R15 and R16 provide the bias for the circuit. Capacitor C16 couples the 4.755 Mc signal to the base of second mixer Q5. Filters FL1 and FL2 in the collector circuit of Q5 provide the desired resolution. FL1 is a ceramic filter providing 12 kc resolution and FL2 is a crystal filter providing 2.5 kc resolution. Filter FL2 is in the circuit only when relay K1 is energized. This is accomplished by placing the KC SWEEP WIDTH switch in the 50 (kc) position. In all other positions relay K1 is deenergized and FL1 is in the circuit. The filter output is applied to the base of 455 kc IF amplifier Q7.

4-44. 455 Kc IF Amplifier.

4-45. Transistor Q7 is the 455 kc IF amplifier. The output of Q7 is stepped up by auto transformer T1 and RC coupled to the envelope detector.

4-46. Envelope Detector.

4-47. The detector rectifies the 455 kc input signal and provides an output voltage which varies according to the input signal envelope. This voltage is applied directly to the vertical deflection plates of the CRT. The circuit includes series diode detectors CR1 and CR3 and identical resistance-capacitance filter networks. The diodes are connected into their respective circuits in opposite directions to provide the positive and negative polarities necessary for push-pull deflection. Since the functional operation of each detector circuit is identical, only one will be discussed. Diode CR3 is the rectifier and resistor R30 is the load. Diode CR3 conducts only during one half of the input cycle and thereby rectifies the 455 kc IF signal. Diode CR4 is a voltage clamp to prevent the vertical deflection plate from dropping below +75 volts. The 455 kc IF is then filtered out by C31 and R28 so that the detector output is the modulation envelope.

4-48. First Swept Local Oscillator.

4-49. Swept oscillator Q8 is connected as a Colpitts configuration with regenerative feedback obtained from the emitter-base tank circuit. The base of Q8 is base biased by R35. The tuned circuit consists of capacitors C35 and C36 in parallel with L7. Variable inductor L7 permits alignment of the 25.7 Mc oscillator center frequency. The output of Q8 has a maximum sweep range of 2 Mc controlled by CR6. Varicap CR6 is connected in series with the oscillator tank circuit and controls the oscillator frequency by varying the tank circuit capacitance. Static bias for CR6 is derived from the CRT FREQ control via pin 6. The CRT FREQ control varies the CR6 bias enough to produce a ±400 kc variation to the 25.7 Mc center frequency. The input to the oscillator is a sawtooth waveform developed in the horizontal sweep circuits on sweep generator A2 A4. When this voltage is applied to the varicap, the sweep oscillator frequency varies in synchronization with the horizontal sweep of the CRT. The sweep width (maximum frequency minus minimum frequency) is determined by the peak-to-peak amplitude of the sawtooth waveform and is controlled by the KC SWEEP WIDTH switch.

4-50. Diode CR5 and load resistors R33 and R34 comprise the sweep linearity network. This network compensates for the nonlinear voltage versus capacitance characteristic of varicap CR6 and provides a linear frequency versus time characteristic output from the sweep oscillator. The action of the diode is essentially that of a voltage-controlled electronic switch.

As the sawtooth voltage input is applied to the network, the switch turns on and R32 is added to the network. With the added load, the waveform is reshaped and a linear relationship of frequency versus time is achieved.

4-51. Marker Oscillator.

4-52. The marker oscillator circuit provides a center frequency marker on the CRT. The circuit contains transistor Q11 connected as a Colpitts configuration with the frequency of oscillation controlled by crystal Y2. From the marker oscillator circuit, the 15 Mc signal is coupled by C44 to the base of Q10. The collector of Q10 is coupled to grounded base amplifier Q9 through variable resistor R39, which provides an amplitude adjustment for the 30 Mc output signal. The collector of Q9 contains a double-tuned circuit aligned for 30 Mc. One tuned circuit consists of L10 and C42 while the second tuned circuit consists of L9 and C39. Capacitor C41 provides coupling between the two circuits. The second tuned circuit applies a 30 Mc signal through C40 to the base of mixer Q1. In the first mixer, the 30 Mc beats with the 25.7 Mc center frequency of the sweep oscillator circuit to provide a 4.3 Mc center frequency marker.

4-53. SWEEP GENERATOR (A2A4) CIRCUIT DESCRIPTION.

4-54. See figure 5-21 for the schematic diagram.

4-55. Sawtooth Generator.

4-56. Transistors Q1 and Q3 and unijunction transistor Q2 develop the sawtooth voltage waveform applied to the sweep oscillator and to the horizontal deflection plates of the CRT. Transistor Q1 is a common emitter, sweep charging source. As Q1 conducts, capacitors C1, C2, C3, and C4 charge very slowly. The charging rate of the capacitors is determined by the setting of the sweep rate adjustment R2. As the capacitors charge, the positive dc voltage across them rises until the voltage is sufficient to cause Q2 to fire. Unijunction transistor Q2 conducts through its low impedance emitter circuit, discharging the capacitors very rapidly. This sequence of slow charging and rapid discharging of the capacitors produces a sawtooth waveform. The rate of charging and discharging the capacitors is set for 30 cps by sweep rate adjustment R2. The sawtooth output of Q1 is applied to the base of emitter follower Q3 to provide isolation between the sawtooth generator and phase splitter Q4.

4-57. Horizontal Deflection Amplifier.

4-58. The horizontal deflection amplifier is used to amplify the output of the sawtooth generator for direct application to the CRT. A portion of the sawtooth is also applied to the sweep oscillator through potentiometer R20 and XA4 pin 2. The sawtooth synchronizes the

first local oscillator with the horizontal sweep on the CRT screen. The output from the sawtooth generator is applied through gain control R6 directly to the base of phase inverter Q4. This results in a 180-degree phase shift between emitter and collector waveforms. The collector and emitter outputs of Q4 are resistance-capacitance coupled to push-pull amplifiers Q5 and Q6. Therefore the resulting inputs applied to the horizontal deflection plates of the CRT are equal in amplitude but opposite in phase.

4-59. CONTROL POTENTIOMETER (A2A3) CIRCUIT DESCRIPTION.

4-60. See figure 5-20 for the schematic diagram. The regulated -1200 vdc from high-voltage regulator VR1 is applied through XA3 pin 15 to a voltage divider consisting of R18, R17, R1, R2, R3 and R4. Resistor R18 varies the voltage applied to the CRT control grid while R2 varies the voltage applied to the CRT first anode. The +150 volts input, pin 7, is applied across a fixed astigmatism circuit and variable positioning adjustments for the CRT trace. Fixed astigmatism is derived from connection of the CRT second anode to the junction of R7 and R8. The output of Zener diode CR1 is applied to CRT FREQ control which varies the bias applied to varicap CR6 on A2A2. Vert potentiometer R10, connected to pin 10, adjusts the static voltage to the output of the envelope detector circuit on A2A2 and provides vertical positioning of the CRT trace. Horiz potentiometer R13, connected to pin 11, adjusts the output of the horizontal sweep circuit on A2A4 to provide horizontal positioning of the CRT trace. Zener diodes CR2 and CR3 in the ±25-volt input circuit provide outputs of ±12 volts to pins 4 and 2.

4-61. OVERALL TEST DATA.

4-62. The overall test data includes a list of test equipment required, fabrication instructions for an RF detector, a preliminary procedure and the checkout and trouble isolation procedures in table 4-1.

4-63. The following test equipment and tools are required for checking the spectrum display unit (SDU).

a. Sweep Generator, Telonic SM-2000 with SH-1 Plug-In Oscillator, or equivalent.
b. X-Y Oscilloscope CBTV-503, or equivalent
c. HF Signal Generator CAQI-606A, or equivalent
d. Test Oscillator CAQI-651, or equivalent
e. Electronic Voltmeter CAQI-410C, or equivalent
f. RF Millivoltmeter CAQI-411A, or equivalent
g. VOM, CSV-260, or equivalent
h. Output Termination CAQI-11507A, or equivalent

i. High Impedance Detector. (Fabricate; refer to paragraph 4-64.)

j. Card Extenders

k. Jumper Cables

4-64. To fabricate the high impedance detector shown schematically in figure 4-2, mount the components on a piece of perforated board or some other bread-boarding material. The components can be laid out as shown in the schematic diagram and soldered directly together.

4-65. Before checking the SDU, perform the following preliminary procedure.

a. Set SDU POWER switch to down position and remove unit from equipment rack.

b. Remove dust cover from unit.

Note

Blank panel and display assembly A2 must be removed to provide access to front-panel screws holding dust cover.

c. Connect jumper cables between P1 and P4, on SDU rear panel, to corresponding jacks on equipment rack.

d. Remove top and bottom dust covers from display assembly A2.

e. Connect jumper cables between P1 and P2, on rear panel of A2, to corresponding jacks on SDU main chassis.

4-66. To observe the waveform at test point (6), set the equipment controls as follows:

a. Sweep Generator:

RF ATTENUATOR ..... 30 db
Center frequency ..... 21.4 Mc
KC SWEEP WIDTH ..... Approximately 4 Mc

b. HF Signal Generator:

MODULATION SELECTOR ..... EXT AC
ATTENUATOR ..... set for nearly full rf output
FREQUENCY ..... 21.4 Mc

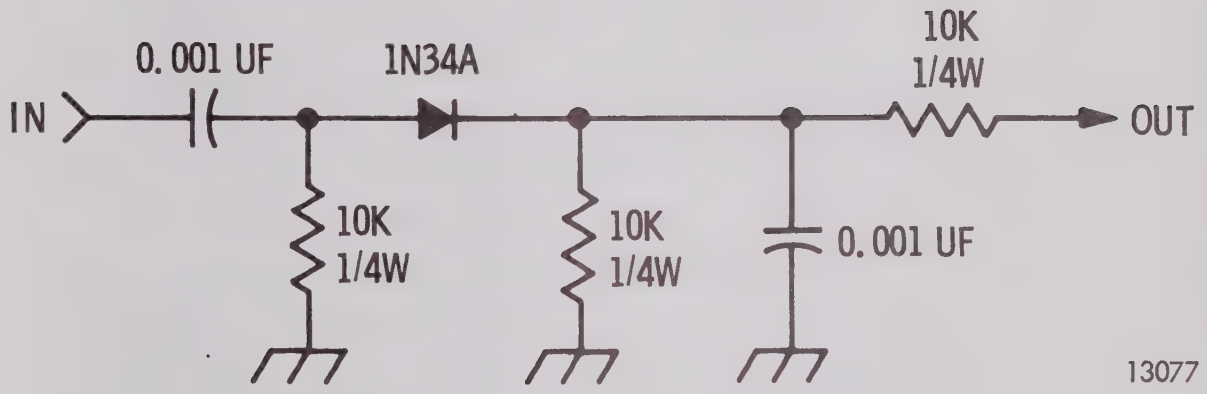


Figure 4-2. High-Impedance Detector Fabrication Drawing

c. Test Oscillator:

FREQUENCY . . . . . 1 Mc
ATTENUATOR . . . . . set for full output

d. X-Y Oscilloscope:

VERT SENSITIVITY . . . . . 5 mv/cm
HORIZ SENSITIVITY. . . . . 1 v/cm
HORIZ DISPLAY . . . . . HORIZ AMPLIFIER

e. Spectrum Display Unit:

POWER . . . . . ON
INPUT CHANNEL 1
MKR . . . . . down position
GAIN . . . . . fully cw
CRT FREQ . . . . . adjust to center display on oscilloscope

4-67. To observe the waveforms at test points (7) and (8), set the equipment controls as follows:

a. Set output termination to provide a 20-db loss.

b. HF Signal Generator:

FREQUENCY. . . . . 21.4 Mc
MODULATION SELECTOR . . . . . cw
ATTENUATOR. . . . . -75 dbm

c. Spectrum Display Unit:

POWER . . . . . ON
INPUT CHANNEL 1
GAIN . . . . . fully cw
MKR . . . . . down position
CRT FREQ . . . . . midrange
KC SWEEP WIDTH 500

d. Oscilloscope:

VERT SENSITIVITY . . . . . 5 mv/cm
HORIZ SENSITIVITY . . . . . 1 v/cm
HORIZ DISPLAY . . . . . HORIZ AMPLIFIER

4-68. SWEEP GENERATOR BOARD (A2A4) TEST DATA.

4-69. The sweep generator board test data includes a list of test equipment required, a preliminary procedure, and the checkout and trouble isolation procedures in Table 4-2.

4-70. The following test equipment is required to check the sweep generator board.

a. Oscilloscope CBTV-503, or equivalent
b. VOM CSV-260, or equivalent.

4-71. Perform the following preliminary procedure prior to checking the sweep generator board.

a. Set SDU POWER switch to down position.
b. Remove A2A4 and place on card extender. (See figure 5-7.)
c. Set SDU POWER switch to ON.

4-72. IF AMPLIFIER AND SWEEP OSCILLATOR BOARD (A2A2) TEST DATA.

4-73. The following test equipment is required to check the IF amplifier and sweep oscillator board.

a. HF Signal Generator CAQI-606A, or equivalent
b. X-Y Oscilloscope CBTV-503, or equivalent
c. High-Impedance Detector. (Refer to paragraph 4-64 for fabrication instructions.)

4-74. Perform the following preliminary procedure prior to checking the IF amplifier and sweep oscillator board.

a. Set SDU POWER switch to down position

b. Remove A2A2 and place on card extender. (See figure 5-9.)

c. Connect equipment as shown in figure 4-3, with CBTV-503 vertical input connected to test point (F) . (See figure 5-11.)

d. Set HF signal generator controls as follows:

FREQUENCY . . . . . 21.4 Mc
ATTENUATOR . . . . . -75 dbm
MODULATION SELECTOR . . . . . cw

e. Set oscilloscope controls as follows:

VERT SENSITIVITY . . . . . 10 mv/cm
HORIZ SENSITIVITY. . . . . 10 v/cm
HORIZ DISPLAY . . . . . HORIZ AMPLIFIER

f. Set SDU controls as follows:

POWER . . . . . ON
INPUT CHANNEL 1
KC SWEEP WIDTH 500
CRT FREQ . . . . . Set to center display on oscilloscope

TABLE 4-1. OVERALL CHECKOUT AND TROUBLE ISOLATION

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1	Set SDU POWER switch to ON. With CSV-260, measure ac voltage across pins 1 and 2 of A1T1. (See figure 5-2.)	115 vac	Check fuses F1 and F2, switch S1 and filters FL1 and FL2. See figure 5-3.
2	With CSV-260, measure ac voltage across all secondaries of A1T1.	Pins / VAC 3-4 / 232 5-4 / 232 6-7 / 41 8-7 / 41	Check A1T1.
3	With CAQI-410C, measure dc voltage at test point (A) . (See figure 5-5.)	+250 vdc	Check diodes CR2 and CR4 on A1A2, and C2 and R2. See figures 5-2 and 5-4.
4	With CAQI-410C, measure dc voltage at test point (B) .	-175 vdc	Check diodes CR1 and CR3 on A1A2, and L1, C1 and R1. See figures 5-2, 5-3 and 5-4.
5	With CAQI-410C, measure dc voltage at test point (C) .	+40 vdc	Check diodes CR6 and CR8 on A1A2, and C4 and R4. See figures 5-3 and 5-4.
6	With CAQI-410C, measure dc voltage at test point (D) .	-40 vdc	Check diodes CR5 and CR7 on A1A2, and C3 and R3.
7	With CAQI-410C, measure dc voltage at test point ⬟3 .	+150 vdc	Check Q5 thru Q9, V1 and associated circuits on A1A1.

TABLE 4-1. OVERALL CHECKOUT AND TROUBLE ISOLATION (Cont)

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
8	With CAQI-410C, measure dc voltage at test point ④ .	+25 vdc	Check Q12, Q13 and associated circuits on A1A1.
9	With CAQI-410C, measure dc voltage at test point ⑤ .	-25 vdc	Check Q10, Q11 and associated circuits on A1A1
10	With CSV-269, measure ac voltage across both secondaries of A2T1. (See figure 5-9.)	Pins / VAC 9-10 / 6.3 5-6 / 532	Check A2T1. (See figure 5-9.)
11	With CAQI-410C, measure dc voltage at test point (U) .	-1200 vdc	Check CR1, CR2, C7A-B, and VR1. (See figures 5-8 and 5-9.)
12	With CAQI-410C, measure dc voltages at test points (R) , (S) and (T) .	R = -1140 vdc S = -1060 vdc T = -700 vdc	Check R1 thru R4, R17 and R18 on A2A3. (See figure 5-12.)
13	With CAQI-410C, measure dc voltage at test point (V) . (See figure 5-12.)	+150 vdc	Check C1, C2 and L1. (See figure 5-8.)
14	With CAQI-410C, measure dc voltage at test point (W) .	-25 vdc	Check C5, C6 and L3. (See figure 5-9.)
15	With CAQI-410C, measure dc voltage at test point (X) .	+25 vdc	Check C3, C4 and L2.

TABLE 4-1. OVERALL CHECKOUT AND TROUBLE ISOLATION (Cont)

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
16	With CAQI-410C, measure dc voltage at test point (O) . (See figure 5-9.)	+115 vdc	Check R7 and R8 on A2A3. (See figure 5-12.)
17	With CAQI-410C, measure dc voltage at test point (P) .	+12 vdc	Check R16 and CR3 on A2A3.
18	With CAQI-410C, measure dc voltage at test point (Q) .	-12 vdc	Check R15 and CR2 on A2A3.
19	With CAQI-410C, measure dc voltage at test point (L) .	+12 vdc	Check R5, R6 and CR1 on A2A3.
20	With CAQI-410C, measure dc voltage at test point (M) .	Approximately +75 vdc.	Check R9 thru R11 on A2A3.
21	With CAQI-410C, measure dc voltage at test point (N) .	Approximately +75 vdc.	Check R12 thru R14 on A2A3.
22	Set INPUT CHANNEL selector to 1. Connect RF OUTPUT of CAQI-606A thru CAQI-11507A termination to terminal E14 on A2 chassis. (See figure 5-9.) Connect input of CAQI-411A to E14.	At least 4.5 millivolts. This corresponds to a gate insertion loss of approximately 1 db or less.	Check C11, CR3 and R12. (See figure 5-9.)

TABLE 4-1. OVERALL CHECKOUT AND TROUBLE ISOLATION (Cont)

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
22 (Cont)	Set CAQI-606A CW frequency to 21.4 Mc and output level to 5 millivolts as read on CAQI-411A. Connect CAQI-411A to test point (E) . Observe CAQI-411 reading.		
23	Repeat step 22 for inputs at terminals E11, E7, E19, E8, E24 and INPUT CHANNEL positions 2 thru 6 respectively. (See figures 5-8 and 5-9.) Observe all gate outputs at test point (E) .	At least 4.5 millivolts for all gates.	Check gate circuitry associated with faulty channel. (See figures 5-8 and 5-9.)
24	Connect equipment as shown in figure 5-1 to observe input amplifier passband at test point 6 . (See figure 5-11.) Set equipment controls as outlined in paragraph 4-66.	See waveform at TP 6 shown on figure 4-5.	Check input amplifier board A2A1 circuitry. (See figure 5-10 for component location DC voltages are listed in table 5-5.)
25	With CBTV-503 oscilloscope, observe waveforms at test points (9) (10) and (G)	See waveforms at test points (9) (10) and (G) on figure 4-5.	Check sweep generator board A2A4 as outlined in table 4-2 if waveforms at test points (9) and (10)

TABLE 4-1. OVERALL CHECKOUT AND TROUBLE ISOLATION (Cont)

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
25 (Cont)	through a 2.2 microfarad capacitor. (See figures 5-9 and 5-11.)		are abnormal. If waveform at test point (G) is abnormal, check S2A-A, R2 thru R6 and A2A4. (See figure 5-9.)
26	Connect equipment as shown in figure 4-3 to observe output of IF amplifier and sweep oscillator board A2A2 at test points (7) and (8). (See figure 5-11.) Set equipment controls as outlined in paragraph 4-67.	See waveforms at test points (7) and (8) on figure 4-5. If waveforms are normal, check CRT voltages. (Refer to table 5-7.)	Check IF amplifier and sweep oscillator board A2A2. (Refer to table 4-3.)

TABLE 4-2. SWEEP GENERATOR BOARD (A2A4) CHECKOUT AND TROUBLE ISOLATION.

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1	With CBTV-503 oscilloscope, observe waveform at test point (K). (See figure 5-13.)	See waveform at test point (K) on figure 4-5.	Check transistors Q1, Q2, and Q3 and associated circuitry. (See figure 5-13. Refer to table 5-7 for dc voltages.)
2	With CBTV-503 oscilloscope, observe waveforms at test points (9) and (10).	See waveforms at test points (9) and (10) on figure 4-5.	If both are abnormal, check Q4 and associated circuitry.

TABLE 4-2. SWEEP GENERATOR BOARD (A2A4) CHECKOUT AND TROUBLE ISOLATION. (Cont)

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL

2 (Cont)			If (9) only is abnormal, check Q5 and associated circuitry.
			If (10) only is abnormal, check Q6 and associated circuitry.
			After correcting fault, perform the sweep alignment outlined in paragraph 5-41.

TABLE 4-3. IF AMPLIFIER AND SWEEP OSCILLATOR BOARD (A2A2) CHECKOUT AND TROUBLE ISOLATION.

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1	Observe waveform on CBTV-503 oscilloscope.	See waveform at test point (F) on figure 4-5.	Check first mixer Q1-Q2, sweep oscillator Q8 and associated circuitry on A2A2. (See figure 5-11.)
2	Connect vertical input of CBTV-503 oscilloscope directly to test point (I) and set HORIZ DISPLAY to SWEEP NORMAL (X1). Set SDU MKR switch to up position. (See figure 5-11.)	See waveform at test point (I) on figure 4-5.	Check marker oscillator Q11 and associated circuitry.

TABLE 4-3. IF AMPLIFIER AND SWEEP OSCILLATOR BOARD (A2A2) CHECKOUT AND TROUBLE ISOLATION. (Cont)

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3	Connect CBTV-503 vertical input to test point (F) through RF detector. Remove CAQI-606A output from terminal E14. Set CBTV-503 HORIZ DISPLAY to HORIZ AMPLIFIER.	See waveform at test point (F) on figure 4-5.	Check frequency doubler Q9-Q10 and associated circuitry.
4	Connect CBTV-503 vertical input directly to test point (H). Set SDU MKR switch to down position. Set CBTV-503 vertical sensitivity to 50 mv/cm, time base to 0.5 μsec/cm and HORIZ DISPLAY to SWEEP NORMAL (X1).	See waveform I at test point (H) on figure 4-5.	Check second local oscillator Q6 and associated circuitry.
5	Connect equipment as shown in figure 4-3 to observe waveform at test point (H). Set CAQI-606A output level to -62 dbm.	See waveform II at test point (H) on figure 4-5.	Check 4.3 Mc IF amplifier Q3-Q4 and associated circuitry.

TABLE 4-3. IF AMPLIFIER AND SWEEP OSCILLATOR BOARD (A2A2) CHECKOUT AND TROUBLE ISOLATION. (Cont)

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5 (Cont)	Set CBTV-503 HORIZ DISPLAY to HORIZ AMPLIFIER, VERT SENSITIVITY to 5 mv/cm and HORIZ SENSITIVITY to 5 v/cm.		
6	Set CAQI-606A output level to -77 dbm. Set SDU KC SWEEP WIDTH to 50. Set CBTV-503 HORIZ SENSITIVITY to 5 v/cm and VERT SENSITIVITY to 5 mv/cm.	See waveform I at test point (J) on figure 4-5.	Check second mixer Q5, filter FL2 and associated circuitry.
7	Set CAQI-606A output level -75 dbm. Set CBTV-503 HORIZ SENSITIVITY to 1 v/cm. Set SDU KC SWEEP WIDTH to 500 kc.	See waveform II at test point (J) on figure 4-5.	Check second mixer Q5, filter FL1 and associated circuitry.
8	With CBTV-503, observe waveforms at test points (7) and (8)	See waveforms at test points (7) and (8) on figure 4-5.	Check 455 kc IF amplifier Q7, envelope detector CR1 and CR3 and associated circuitry.

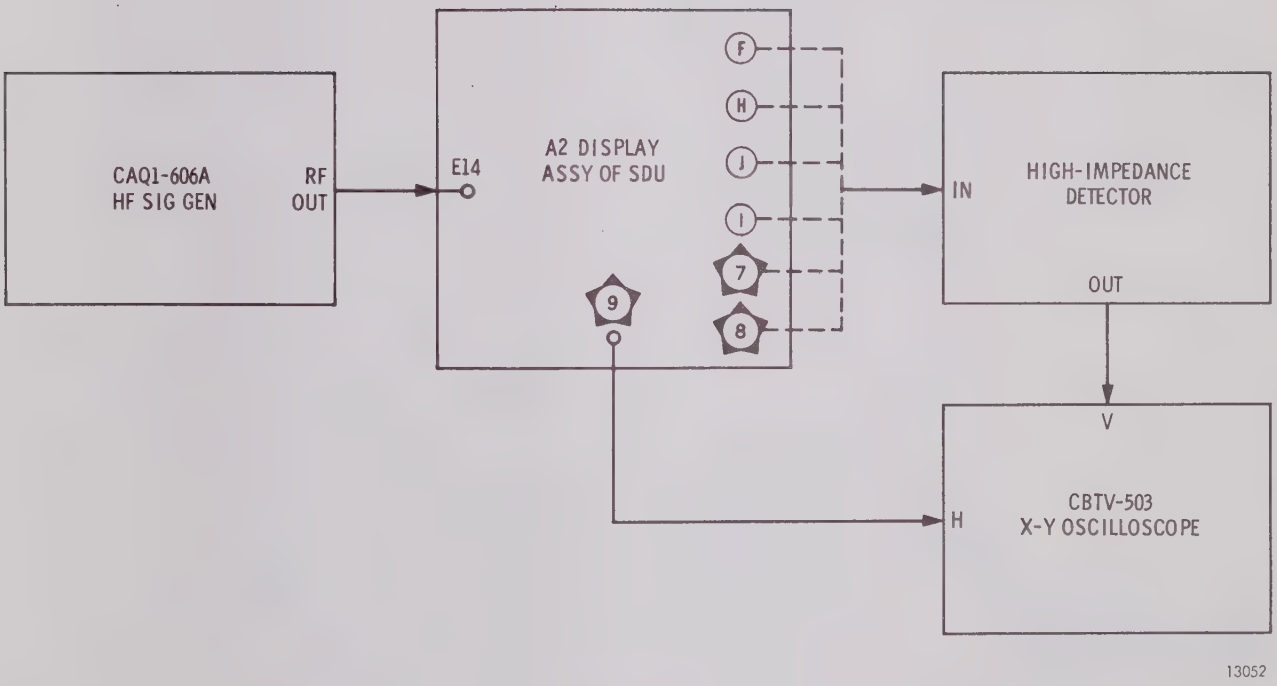


Figure 4-3. IF Amplifier and Sweep Oscillator Board (A2A2), Checkout Setup

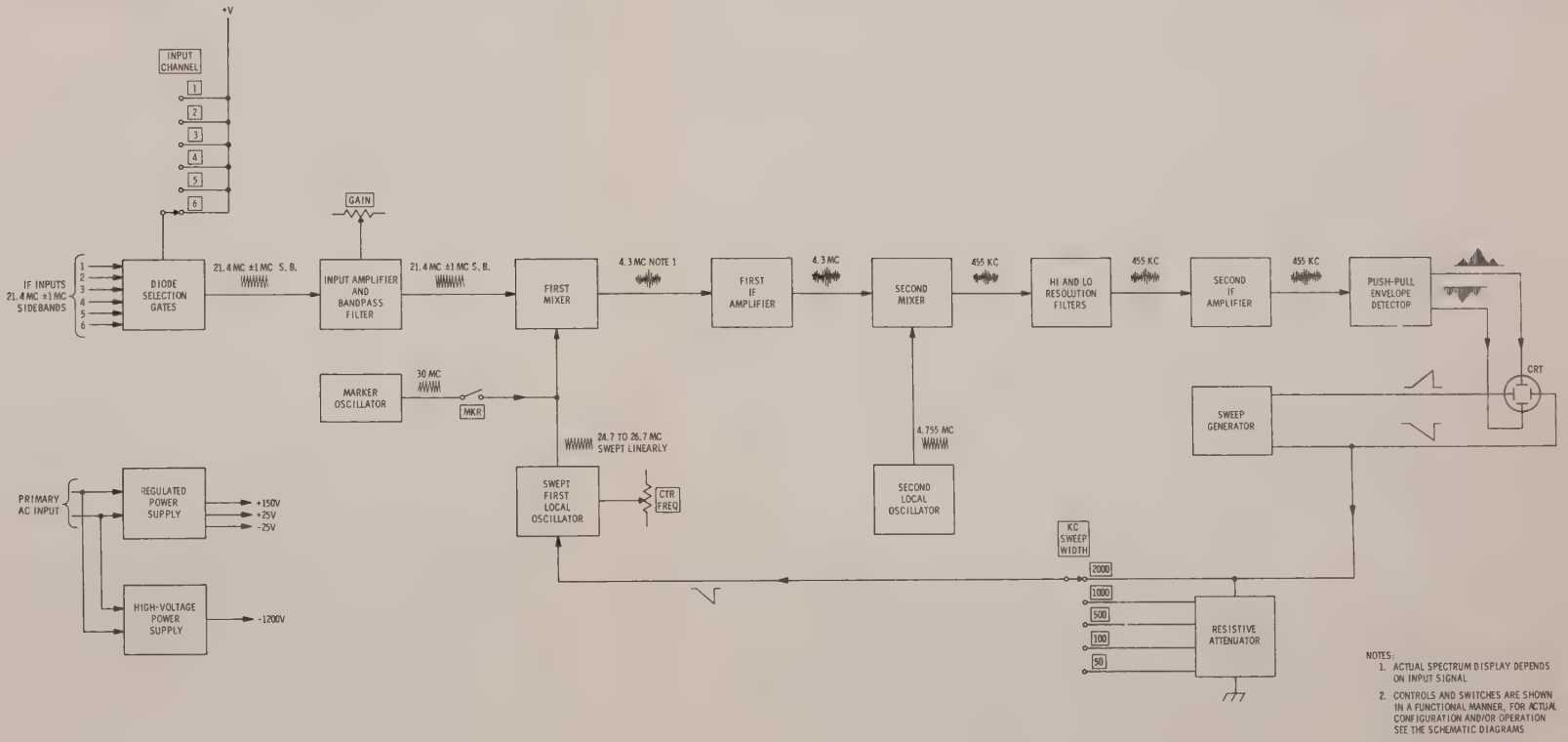


Figure 4-4. Spectrum Display Unit Functional Block Diagram

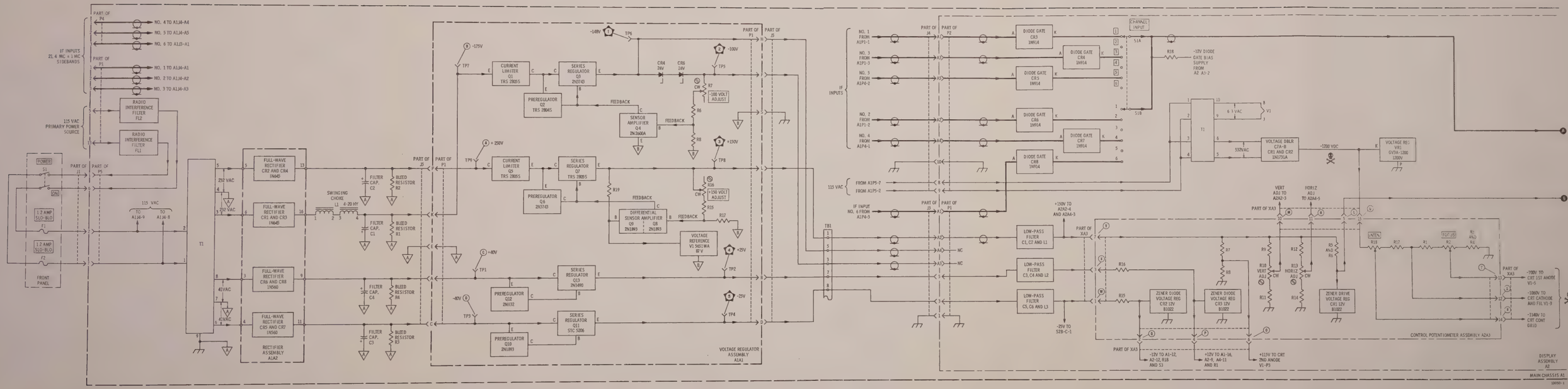


Figure 4-5. Spectrum Display Unit Servicing Block Diagram (Sheet 1 of 2)

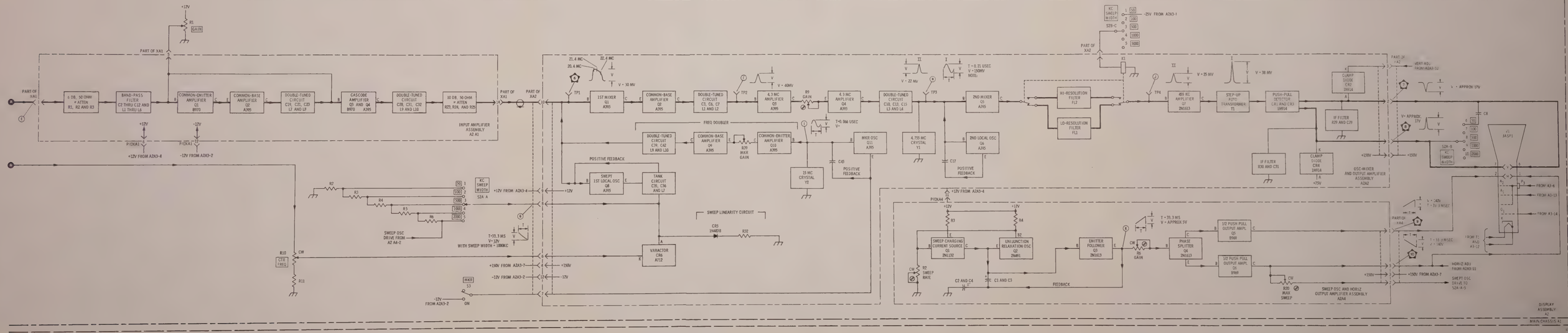


Figure 4-5. Spectrum Display Unit Servicing Block Diagram (Sheet 2 of 2)

SECTION 5

MAINTENANCE

5-1. SCOPE.

5-2. This section contains information and instructions for maintenance and repair of the spectrum display unit.

5-3. PERFORMANCE TESTS.

5-4. Table 5-1 lists tests to determine the performance of the spectrum display unit (SDU). The tests should be performed periodically as indicated, or after any repairs or adjustments and the test results recorded for future comparison.

TABLE 5-1. PERFORMANCE TEST SCHEDULE

TEST	WHEN PERFORMED	REFERENCE
Sensitivity	3 month intervals	Paragraph 5-5
Sweep Width	3 month intervals	Paragraph 5-9
Frequency vs. Amplitude	3 month intervals	Paragraph 5-13

5-5. SENSITIVITY.

5-6. This test measures the 21.4 Mc input level necessary to produce a one-inch vertical deflection on the SDU display.

5-7. The only test equipment required for the sensitivity test is HF signal generator CAQI-606A and Output Termination CAQI-11570A, or equivalents.

5-8. To measure the sensitivity, proceed as follows:

a. Remove display assembly A2 from main chassis of SDU and connect jumper cables between P1 and P2 on A2 and J3 and J4, respectively, on SDU main chassis.

b. Remove dust covers from A2.

c. Set SDU controls as follows:

POWER . . . . . ON
INPUT CHANNEL 1

MKR . . . . . up position
GAIN . . . . . fully cw
KC SWEEP WIDTH 2000

d. Adjust CTR FREQ control to position marker directly under vertical line on SDU face plate.

e. Set MKR switch to down position.

f. Connect output of HF signal generator, through the output termination to terminal E14 on A2 chassis. (See figure 5-9.)

g. Set signal generator frequency to 21.4 Mc and carefully adjust to place signal under vertical line on SDU face plate.

h. Adjust signal generator output level to produce full-scale deflection on SDU display.

i. The RF level output of the signal generator, as read on attenuation controls and meter, should be 100 microvolts or less. This corresponds to an SDU input of 10 microvolts or less.

5-9. SWEEP WIDTH.

5-10. This test checks the five sweep widths of the SDU.

5-11. The test equipment required to check the sweep width:

a. Test Oscillator CAQI-651A, or equivalent.
b. HF Signal Generator CAQI-606A, or equivalent.

5-12. To check the sweep width, proceed as follows:

a. Remove display assembly A2 from main chassis and connect jumper cables between P1 and P2 on A2 and J3 and J4, respectively, on SDU main chassis.

b. Remove dust covers from A2.

c. Set SDU controls as follows:

POWER . . . . . ON
INPUT CHANNEL 1
MKR . . . . . up position
GAIN . . . . . mid range
KC SWEEP WIDTH 50

d. Adjust CTR FREQ control to position marker under vertical line on SDU face plate.

e. Set MKR switch to down position.

f. Connect output of HF signal generator to terminal E14 on A2 chassis. (See figure 5-9.)

g. Set HF signal generator frequency to 21.4 Mc and carefully adjust to position signal under vertical line on SDU face plate.

h. Connect output of test oscillator to external modulation input jack on HF signal generator.

i. Set test oscillator frequency to 25 kc and reduce output level until two side band markers are clearly seen.

j. Adjust test oscillator frequency to position side band markers at the two extremes of horizontal line on SDU face plate.

k. Test oscillator frequency should be 25 kc. This corresponds to an SDU sweep width of 50 kc.

l. Repeat steps i through k with KC SWEEP WIDTH set to 100 and a test oscillator frequency of 50 kc.

m. Repeat steps i through k with KC SWEEP WIDTH set to 500 and a test oscillator frequency of 250 kc.

n. Repeat steps i through k with KC SWEEP WIDTH set to 1000 and a test oscillator frequency of 500 kc.

o. Repeat steps i through k with KC SWEEP WIDTH set to 2000 and a test oscillator frequency of 1000 kc.

5-13. FREQUENCY VS. AMPLITUDE.

5-14. This test checks the displayed amplitude versus frequency of a CW signal tuned across the widest sweep.

5-15. The only test equipment required is HF Signal Generator CAQI-606A and Output Termination CAQI-11570A, or equivalents.

5-16. To check the frequency versus amplitude characteristic of the SDU, proceed as follows:

a. Remove display assembly A2 from main chassis and connect jumper cables between P1 and P2 on A2 and J3 and J4, respectively, on SDU main chassis.

b. Remove dust covers from A2.

c. Set SDU controls as follows:

POWER . . . . . ON
INPUT CHANNEL 1
MKR . . . . . up position
GAIN . . . . . mid range
KC SWEEP WIDTH 2000

d. Adjust CTR FREQ control to position marker directly under vertical line on SDU face plate.

e. Set MKR switch to down position.

f. Connect HF signal generator output through output termination to terminal E14 on A2 chassis. (See figure 5-9.)

g. Set HF signal generator frequency to 21.4 Mc and output level to produce half-scale deflection on SDU display.

h. While observing SDU display, slowly tune HF signal generator frequency from 20.4 Mc to 22.4 Mc.

i. The amplitude should not vary more than ±15% from half-scale deflection over entire range.

5-17. PREVENTIVE MAINTENANCE.

5-18. Table 5-2 lists the periodic schedules for inspection and cleaning of the spectrum display unit.

TABLE 5-2. PREVENTIVE MAINTENANCE SCHEDULE

ROUTINE	SCHEDULE
Inspection (paragraph 5-19)	Monthly
Cleaning (paragraph 5-21)	Monthly

5-19. INSPECTION.

5-20. The spectrum display unit should be inspected periodically for indications of mechanical and electrical defects. Electronic components that show signs of overheating, leakage, frayed insulation and other signs of deterioration should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Mechanical parts should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

5-21. CLEANING.

5-22. The unit should be kept free of dust, moisture, grease, and foreign matter to ensure trouble-free operation. A dry, clean cloth, a soft bristled brush or a cloth saturated with cleaning compound can be used.

5-23. ALIGNMENT AND ADJUSTMENT.

5-24. Paragraphs 5-25 through 5-49 contain the alignment and adjustment procedures for the spectrum display unit.

5-25. PRELIMINARY PROCEDURE.

5-26. Prior to alignment or adjustment, perform the following steps:

a. Remove display assembly A2 from SDU main chassis and place on work bench.

b. Remove top or bottom dust cover as required.

c. Connect jumper cables between P1 and P2 on A2 and J3 and J4, respectively, on SDU main chassis.

5-27. VOLTAGE REGULATOR (A1A1) ADJUSTMENTS.

5-28. The following adjustments set the output voltages of the voltage regulator to their correct levels.

5-29. The only test equipment required to adjust output voltages is the Electronic Voltmeter CAQI-410C, or equivalent.

5-30. To adjust the regulator voltages, proceed as follows:

a. Set POWER switch to ON.

b. Connect CAQI-410C to test point ③. (See figure 5-5.)

c. On A1A1, adjust R16, +150 volt adjust, for a reading of +150 VDC on meter. (See figure 5-5.)

5-31. INPUT AMPLIFIER (A2A1) ALIGNMENT.

5-32. This alignment centers the input amplifier passband at 21.4 Mc and sets and 1 db bandwidth at 2 Mc.

5-33. The following test equipment is required to align the input amplifier.

a. Sweep Generator, Tektronix SM-2000 with SH-1 plug-in oscillator, or equivalent.

b. X-Y Oscilloscope CBTV-503, or equivalent.

c. HF Signal Generator CAQI-606A, or equivalent.

d. High-impedance detector. (Refer to paragraph 4-64.)

5-34. Perform the following preliminary procedure before aligning the input amplifier.

a. Place input amplifier A2A1 on card extender. Remove any key(s) in connector.

b. Connect test equipment as shown in figure 5-1.

c. Set SDU controls as follows:

POWER . . . . . ON
INPUT CHANNEL 1
MKR . . . . . down position
GAIN . . . . . fully cw

5-35. To align the input amplifier, proceed as follows:

a. Set oscilloscope HORIZ DISPLAY to HORIZ AMPLIFIER, HORIZ SENSITIVITY for full-scale horizontal deflection and VERT SENSITIVITY to 2 mV/cm.

b. Adjust output level of HF signal generator and marker gain on sweep generator for markers just large enough to see on oscilloscope.

c. Adjust frequency of sweep generator to 21.4 Mc as indicated by presence of signal in center of oscilloscope trace.

d. On A2A2, adjust L7, L8, L9 and L10 for a response as shown by waveform at test point ⑥ on figure 4-5. Reduce the RF output level of the sweep generator as required to maintain a peak-to-peak response on the oscilloscope of approximately 6 mv or less.

5-36. 455 KC AND 4.3 MC IF ALIGNMENT.

5-37. This alignment procedure sets the gain of the 455 kc and 4.3 Mc amplifiers to a maximum.

5-38. The only test equipment required to align the IF amplifiers is the HF Signal Generator CAQI-606A, or equivalent.

5-39. Perform the following preliminary procedure prior to adjusting the IF amplifiers.

a. Remove input amplifier board A2A1 from its connector for the duration of this alignment procedure. (See figure 5-7.)

b. Connect HF signal generator output through a 0.01 microfarad capacitor to test point (J) on A2A2. (See figure 5-11.)

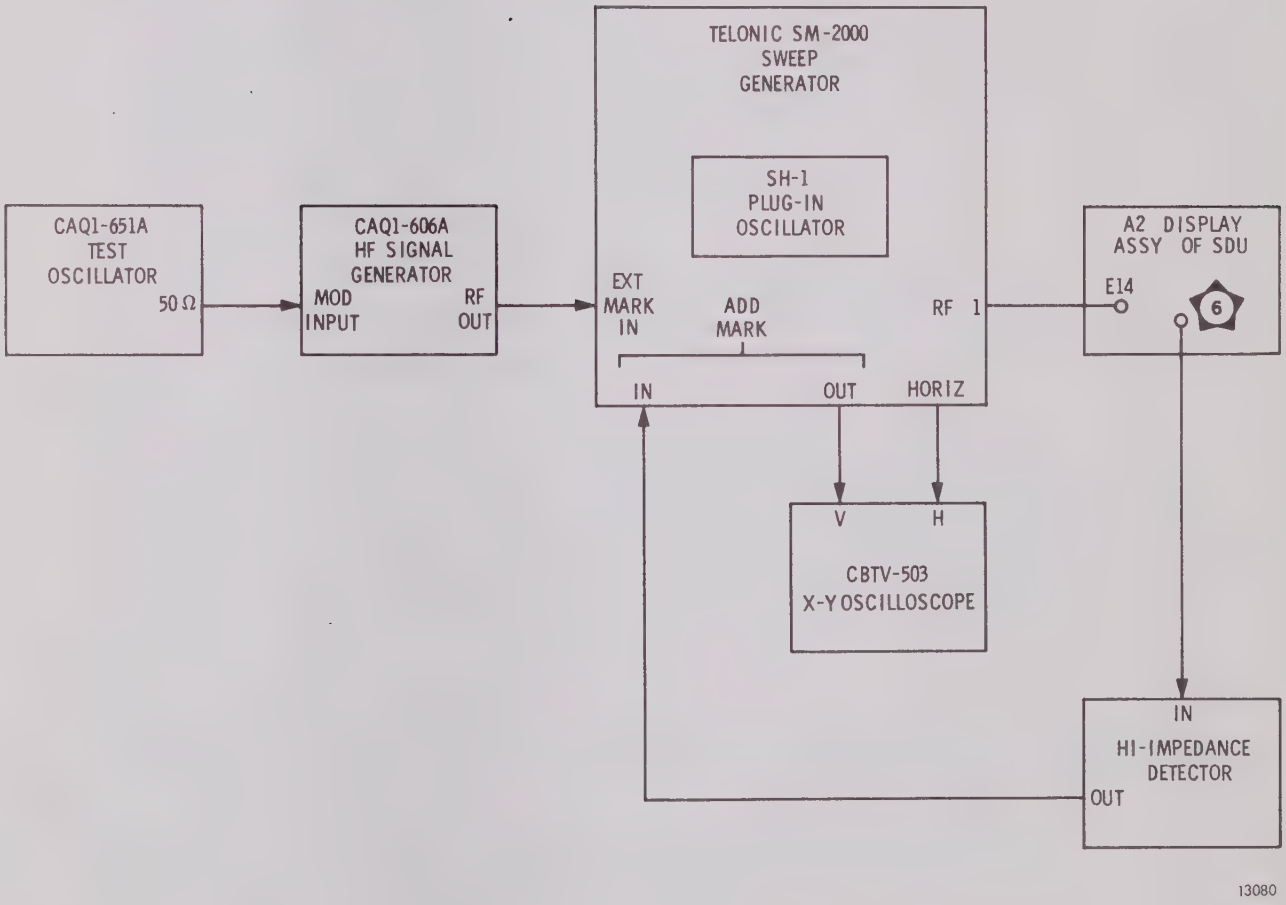


Figure 5-1. Input Amplifier Alignment Test Setup

c. Set HF signal generator frequency to 455 kc.

d. Set SDU POWER switch to ON and MKR switch to down position.

5-40. To adjust the 455 kc and 4.3 Mc amplifiers, proceed as follows:

a. Set HF signal generator output level for half-scale deflection on SDU display.

b. On A2A2, adjust T1 for a maximum deflection on SDU display.

c. Remove HF signal generator output from test point J and connect to test point (H).

d. Set SDU KC SWEEP WIDTH to 2000.

e. Vary HF signal generator frequency on both sides of 455 kc to ensure that signal generator frequency is within passband of FL1. Set HF signal generator frequency to 455 kc.

f. Reduce HF signal generator output level for half-scale deflection on SDU display.

g. On A2A2, adjust L5 for maximum deflection on SDU display.

h. Readjust T1 for maximum deflection.

i. Remove HF signal generator from test point (H) and connect to test point (F).

j. Set HF signal generator frequency to 4.3 Mc and output level for a half-scale deflection on SDU display.

k. On A2A2, adjust L3 and L4 for maximum deflection on SDU display.

l. Remove HF signal generator from test point (F) and connect to test point ⑥.

m. Adjust HF signal generator output level for a half-scale deflection on SDU display.

n. On A2A2, adjust L1 and L2 for maximum deflection on SDU display.

5-41. SWEEP ALIGNMENT.

5-42. This procedure provides information for adjusting the sweep generator, the swept oscillator and the marker oscillator.

5-43. The following test equipment is required to align the sweep circuits.

a. Test Oscillator CAQI-651A, or equivalent

b. Oscilloscope CBTV-503, or equivalent

c. HF Signal Generator CAQI-606A, or equivalent.

5-44. Perform the following preliminary procedure before aligning the sweep circuits.

a. Remove input amplifier board A2A1 from its connector. (See figure 5-7.)

b. Place sweep generator board A2A4 on card extender. Remove any key(s) in connector.

c. Connect output of HF signal generator to test point ⑥ . (See figure 5-11.)

d. Set HF signal generator frequency to 21.4 Mc.

e. Set SDU POWER switch to ON, CTR FREQ control to mid range and KC SWEEP WIDTH switch to 50.

5-45. To align the sweep circuits, proceed as follows:

a. On A2A2, adjust L7 to center marker on SDU display. (See figure 5-11.)

b. Set SDU KC SWEEP WIDTH to 2000.

c. Connect oscilloscope to test point ⑩ . (See figure 5-9.)

d. On A2A4, adjust R2 for a 30 cps sawtooth waveform.

e. Remove HF signal generator from test point ⑥ .

f. Insert A2A1 into its connector.

g. Set SDU INPUT CHANNEL to 1 and MKR switch to up position.

h. With CTR FREQ control centered; adjust L7, L9 and L10 on A2A2 for maximum deflection on SDU display. (See figure 5-11.)

i. Also on A2A2, adjust R39 for full-scale marker on SDU display.

j. Connect HF signal generator to terminal E14 on chassis of display assembly A2. (See figure 5-9.) A marker deflection similar to the one in step i should be seen on SDU display.

k. Connect output of test oscillator to the external modulation input jack on HF signal generator.

l. Set test oscillator frequency to 1 Mc.

m. Reduce test oscillator output attenuation until two side band spectral lines are clearly seen on SDU display.

n. On A2A4, adjust R6 and R20 so that the two side band spectral lines are positioned at the end markers of the horizontal line on the SDU face plate. (See figure 5-13.) To keep the display centered in the horizontal plane, adjust the horiz potentiometer.

5-46. CRT VOLTAGE ADJUSTMENTS.

5-47. These adjustments set the CRT operating voltages that control intensity, focus and vertical position.

5-48. Perform the following preliminary procedure before performing the adjustments.

a. Set SDU POWER switch to ON.

b. Set MKR switch to up position.

5-49. To adjust the CRT voltages, proceed as follows:

a. Adjust intensity potentiometer for desired viewing intensity. (See figure 5-6.)

b. Adjust focus potentiometer for sharpest display.

c. Adjust vert potentiometer to place horizontal sweep directly under horizontal line on the SDU faceplate.

5-50. REPAIR.

5-51. Repair instructions for the SDU consist of removal and replacement of the CRT and printed-circuit card repair.

5-52. CRT REMOVAL AND REPLACEMENT.

WARNING

To prevent personal injury, always wear gloves and goggles or a face mask when handling the CRT. Handle the CRT very carefully.

5-53. Removal.

a. Loosen the four captive screws holding display assembly A2 and remove A2 from main chassis.

b. Remove top dust cover from A2.

c. Remove the four screws holding CRT bezel.

d. Disconnect high-voltage lead from CRT. (See figure 5-7.)

e. Remove CRT base socket.

f. Loosen the two screws holding CRT base support bracket and slide bracket toward the rear.

g. Carefully push CRT forward and out of CRT shield.

5-54. Replacement.

a. Carefully slide CRT into shield.

b. Replace CRT bezel, gasket and face plate.

c. Slide CRT support bracket forward and tighten screws.

d. Replace high-voltage lead.

e. Replace CRT base socket.

f. Replace top cover.

g. Install A2 in main chassis and tighten screws.

h. Perform CRT voltage adjustments as outlined in paragraph 5-46.

5-55. PRINTED-CIRCUIT CARD REPAIR.

5-56. The instructions for printed-circuit (PC) card repair include replacement of defective components, repair of broken printed wiring, and repair of broken cards. Table 5-3 contains a list of tools and materials recommended for printed-circuit card repair.

TABLE 5-3. TOOLS AND MATERIALS RECOMMENDED FOR PRINTED-CIRCUIT CARD REPAIR

NAME	MANUFACTURER'S DESIGNATION	USE
Pencil Soldering Iron, 27-1/2 Watt	Ungar Model 776	Applies heat to solder joints
Chisel-Point Soldering Iron Tip, 1/4-Inch Diameter	Ungar Model 1233	Applied solder to connection
Thread-In Element for Desoldering Tipletts	Ungar Model 4045	Inserted in soldering pencil to hold and heat desoldering tipletts
Thread-In Cone Tiplett, 3/8-Inch Diameter	Ungar Model PL331	Applies heat to confined area such as eyelets on PC card
Thread-In Cup Tiplett, 3/4-Inch Diameter	Ungar Model 855	Simultaneously applies heat to more than one contact when desoldering components with multiple contacts
Thread-In Triangle Tiplett, 5/8-Inch Diameter	Ungar Model 861	Simultaneously applies heat to more than one contact when desoldering components with multiple contacts
Thread-In Bar Tiplett, 1-1/2-Inch by 3/8-Inch	Ungar Model 858	Simultaneously applies heat to more than one contact when desoldering. Used for removing relays
Seizer (thermostatic), Straight-Nosed	Xcelite Model 42H	Used as a heat sink

TABLE 5-3. TOOLS AND MATERIALS RECOMMENDED FOR PRINTED-CIRCUIT CARD REPAIR (Cont)

NAME	MANUFACTURER'S DESIGNATION	USE
End-Cutting Diagonal Pliers, 4-1/2-Inch	Klein Model 224	Used for clipping component leads on PC card
Solder, Rosin Core	Kester Printed Circuit Solder No. 44	Used for soldering joints on PC card
Standard 6-Inch Needle-Nosed Pliers		General repair work
Standard 6-Inch Diagonal Pliers		General repair work
Electrician's Knife		General repair work
Probe and Alignment Tool	General Cement GC9093	Used as soldering aid and probe
Scraper and Brush Tool	General Cement GC9094	Used as soldering aid, PC card scraper, and cleaner
Insulating Varnish	GFE (MIL-V-1137A)	Insulates bare leads
Epoxy Bonding Compound	Emerson and Cuming, Eccobond 55	Repairs bond between component and PC card. Seals breaks in PC cards
Metal Drill Brace, 10-Inch		Used to drill holes in PC cards
Metal Drill Bit, 1/16-Inch Diameter		Used with brace
Printed-Circuit Board Fixture	Technical Devices Co.	Holds PC card
Printed-Wiring Board Repair Kit	Techniques 5110 Kit	Supplies materials for PC card repair
Wire Staples	Aceliner No. 2025	Clamps broken sections of PC card together

TABLE 5-3. TOOLS AND MATERIALS RECOMMENDED FOR PRINTED-CIRCUIT CARD REPAIR (Cont)

NAME	MANUFACTURER'S DESIGNATION	USE
Illuminated Magnifier	Luxo Magnifier Lamp Model FL-1	Enables minute inspection of PC card
Methyl chloroform		Clean PC cards

5-57. Component Replacement.

5-58. To replace a defective component, proceed as follows:

a. Remove PC card from unit. (Refer to appropriate removal and replacement procedure.)

b. Mount card in PC board fixture.

c. Carefully locate part to be removed. Check appropriate parts location illustration and schematic diagram to ensure that proper component has been located.

d. If component leads are exposed:

(1) Clip component leads on component side of card.

(2) Touch soldering iron to eyelet for 3 to 5 seconds and lift wire lead out from under-side of card with needle-nosed pliers.

CAUTION

In step e, use a heat sink to protect heat-sensitive components near the component being removed.

Note

In step e, it may be possible to heat all eyelets simultaneously with one of the special soldering tipletts.

e. If component leads are not exposed, touch soldering iron to eyelet of one component lead while pressing carefully on side of component, lifting it slightly away from card. Repeat this procedure for each lead until component is free of card.

CAUTION

In step f, use a heat sink to protect heat sensitive components.

f. Replace component, solder, and clip off leads close to eyelets as possible.

g. Use insulating varnish to reseal both sides of card.

5-59. Printed-Wiring Repair.

5-60. To repair a break in the printed wiring, proceed as follows:

a. Remove PC card from unit.

b. Place PC card in PC board fixture.

c. With blade of pocket knife, lightly scrape away insulating material on printed wire. Remove insulating material 1/4-inch along wire on both sides of break.

CAUTION

To prevent damage to printed wire, do not apply soldering iron longer than 3 to 5 seconds.

d. If break is no more than slight crack, place solder on break and apply soldering iron.

e. If break is too large to be repaired by drop of solder, place 1/2-inch piece of stripped No. 24 AWG wire across break on printed wire. Apply solder at ends of wire and printed wire, and hold soldering iron on solder for 3 to 5 seconds.

f. When soldered joints have cooled, spray or paint insulating varnish on the break.

5-61. Card Repair.

5-62. Although a broken PC card cannot be restored to its original state of rigidity, it can be temporarily repaired if the damage is not extensive. To repair a broken card, proceed as follows:

a. Remove PC card from unit. (Refer to appropriate removal and replacement procedure.)

b. Place broken card in PC board fixture with break perpendicular to clamp sides of fixture. If break is diagonal to an edge, cut two strips of sheet metal, 1/2-inch wide, to length of card and mount strips under card in PC board fixture.

c. Remove bonding and insulating materials along break with pocket knife or scraper and brush tool, and methyl chloroform. Clean strip on break approximately 3/4-inch wide.

d. With brace and bit, drill holes 1/4-inch away from break on both sides of break. Space holes where space between printed wires is less than 1/4-inch.

e. Insert 1/2-inch wire staples in alternate holes across break on one side of card. Clamp staples by hand.

f. Turn over card. Insert staples in remaining holes and clamp staples.

g. Repair any broken printed wires. (Refer to printed wiring repair.)

h. Cut 1/2-inch wide strips of epoxy glass long enough to cover break on both sides of card. Use 1/64-inch thick epoxy glass.

i. Paint break on both sides with epoxy bonding compound.

k. When bonding compound is dry, paint a second coating over repaired area and let dry.

l. Under illuminated magnifiers, inspect printed wiring for additional cracks not in immediate vicinity of break.

5-63. VOLTAGE CHARTS.

5-64. Tables 5-4 through 5-7 provide the voltages for all active elements used in the SDU.

5-65. ILLUSTRATIONS.

5-66. Figure 5-1 shows the input amplifier alignment test setup, figures 5-2 through 5-13 show component and test point locations, figure 5-14 is the primary power distribution schematic diagram, figures 5-15 and 5-16 are the unit interconnecting diagrams and figures 5-17 through 5-21 are the schematic diagrams.

TABLE 5-4. VOLTAGE REGULATOR (A1A1) VOLTAGE MEASUREMENTS.

TRANSISTOR OR TEST POINT		VOLTAGES (DC)
Notes 1. All voltage measurements made with POWER switch set to ON, MKR switch in down position, GAIN control fully clockwise, KC SWEEP WIDTH set to 500 and with no IF inputs. 2. All voltages taken with Electronic Voltmeter CAQI-410C.		
Q1	Emitter Base Collector	
Q2	Emitter Base Collector	
Q3	Emitter Base Collector	
Q4	Emitter Base Collector	
Q5	Emitter Base Collector	+250 +250 +260
Q6	Emitter Base Collector	+240 +240 +175

TABLE 5-4. VOLTAGE REGULATOR (A1A1)
VOLTAGE MEASUREMENTS. (Cont)

TRANSISTOR OR TEST POINT		VOLTAGES (DC)
Q7	Emitter	+150
	Base	+150
	Collector	+250
Q8	Emitter	+85
	Base	+85
	Collector	+150
Q9	Emitter	+85
	Base	+85
	Collector	+150
Q10	Emitter	-32
	Base	-32
	Collector	-28
Q11	Emitter	-28
	Base	-28
	Collector	-35
Q12	Emitter	+39
	Base	+38
	Collector	+28
Q13	Emitter	+28
	Base	+28
	Collector	+42

TABLE 5-5. INPUT AMPLIFIER (A2A1)
VOLTAGE MEASUREMENTS.

TRANSISTOR OR TEST POINT		VOLTAGES (DC)
Notes 1. All voltage measurements made with POWER switch set to ON, MKR switch in down position, GAIN control fully clockwise, KC SWEEP WIDTH set to 500 and with no IF inputs. 2. All voltages taken with Electronic Voltmeter CAQI-410C.		
Q1	Emitter	-1.0
	Base	-0.3
	Collector	+10.5
Q2	Emitter	-0.6
	Base	0.0
	Collector	+11.2
Q3	Emitter	-0.8
	Base	-0.005
	Collector	+10.7
Q4	Emitter	-0.6
	Base	0.0
	Collector	+11.5

TABLE 5-6. IF AMPLIFIER AND SWEEP OSCILLATOR (A2A2) VOLTAGE MEASUREMENTS.

TRANSISTOR OR TEST POINT		VOLTAGES (DC)
Notes 1. All voltage measurements made with POWER switch set to ON, MKR switch in down position, GAIN control fully clockwise, KC SWEEP WIDTH set to 500 and with no IF inputs. 2. All voltages taken with Electronic Voltmeter CAQI-410C.		
Q1	Emitter	-7.4
	Base	-6.8
	Collector	-0.7
Q2	Emitter	-0.7
	Base	0.0
	Collector	+8.0
Q3	Emitter	-0.8
	Base	-0.2
	Collector	+8.0
Q4	Emitter	-0.7
	Base	0.0
	Collector	+6.8
Q5	Emitter	-8.2
	Base	-7.7
	Collector	0.0
Q6	Emitter	+9.0
	Base	+6.4
	Collector	+11.5

TABLE 5-6. IF AMPLIFIER AND SWEEP OSCILLATOR (A2A2) VOLTAGE MEASUREMENTS. (Cont)

TRANSISTOR OR TEST POINT		VOLTAGES (DC)
Q7	Emitter	-1.0
	Base	-0.35
	Collector	+13.0
Q8	Emitter	-7.0
	Base	-6.4
	Collector	0.0
Q9	Emitter	-0.6
	Base	0.0
	Collector	+12.4
Q10	Emitter	-7.0
	Base	-6.3
	Collector	-0.8
Note To measure voltages at Q11, place MKR switch to up position.		
Q11	Emitter	-7.8
	Base	-7.7
	Collector	0.0

TABLE 5-7. SWEEP GENERATOR (A2A4) AND CRT VOLTAGE MEASUREMENTS.

TRANSISTOR OR TEST POINT		VOLTAGES (DC)
Notes 1. All voltage measurements made with POWER switch set to ON, MKR switch in down position, GAIN control fully clockwise, KC SWEEP WIDTH set to 500 and with no IF inputs. 2. All voltages taken with Electronic Voltmeter CAQI-410C.		
Q1	Emitter	+9.2
	Base	+8.6
	Collector	+3.7
Q2	Emitter	+3.7
	Base 1	0.0
	Base 2	+8.6
Q3	Emitter	+3.0
	Base	+3.7
	Collector	+13.0
Q4	Emitter	+2.2
	Base	+3.0
	Collector	+10.0
Q5	Emitter	+1.5
	Base	+2.0
	Collector	+90.0
Q6	Emitter	+1.5
	Base	+2.0
	Collector	+90.0

TAB:E 5-7. SWEEP GENERATOR (A2A4) AND CRT VOLTAGE MEASUREMENTS. (Cont)

TRANSISTOR OR TEST POINT	VOLTAGES (DC)
V1, Pin 1	+70
2	+69
3	-1060
4	-1140
5	-700
6	+66
7	+70
8	-1120

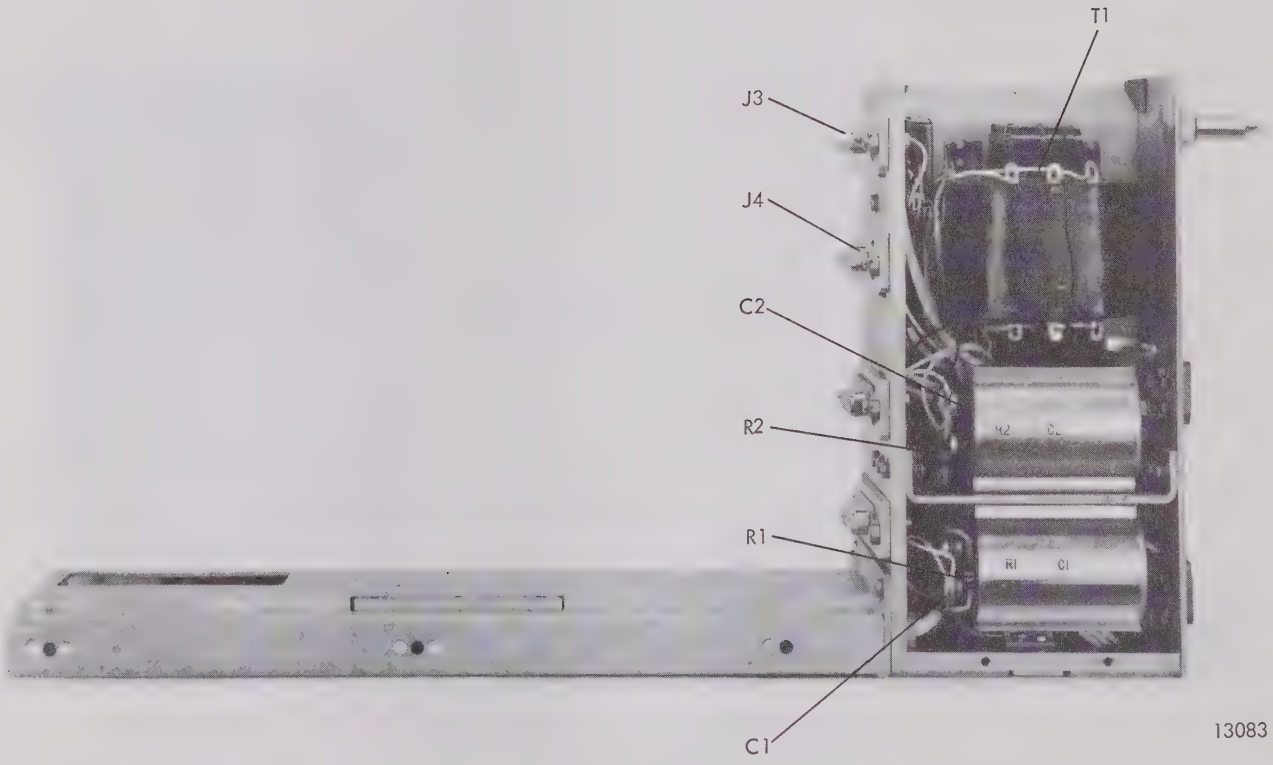


Figure 5-2. Power Supply Assembly (A1), Right Side View

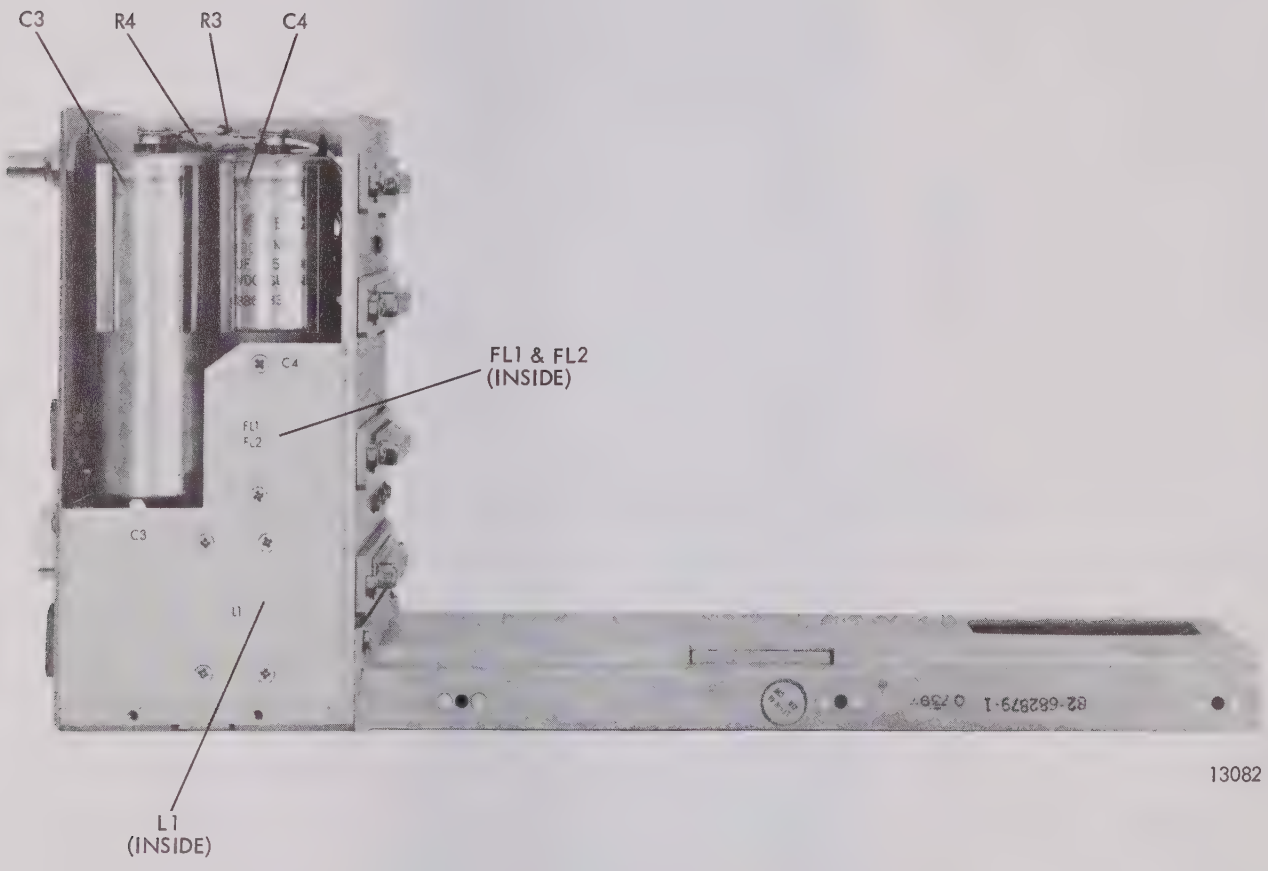


Figure 5-3. Power Supply Assembly (A1), Left Side View

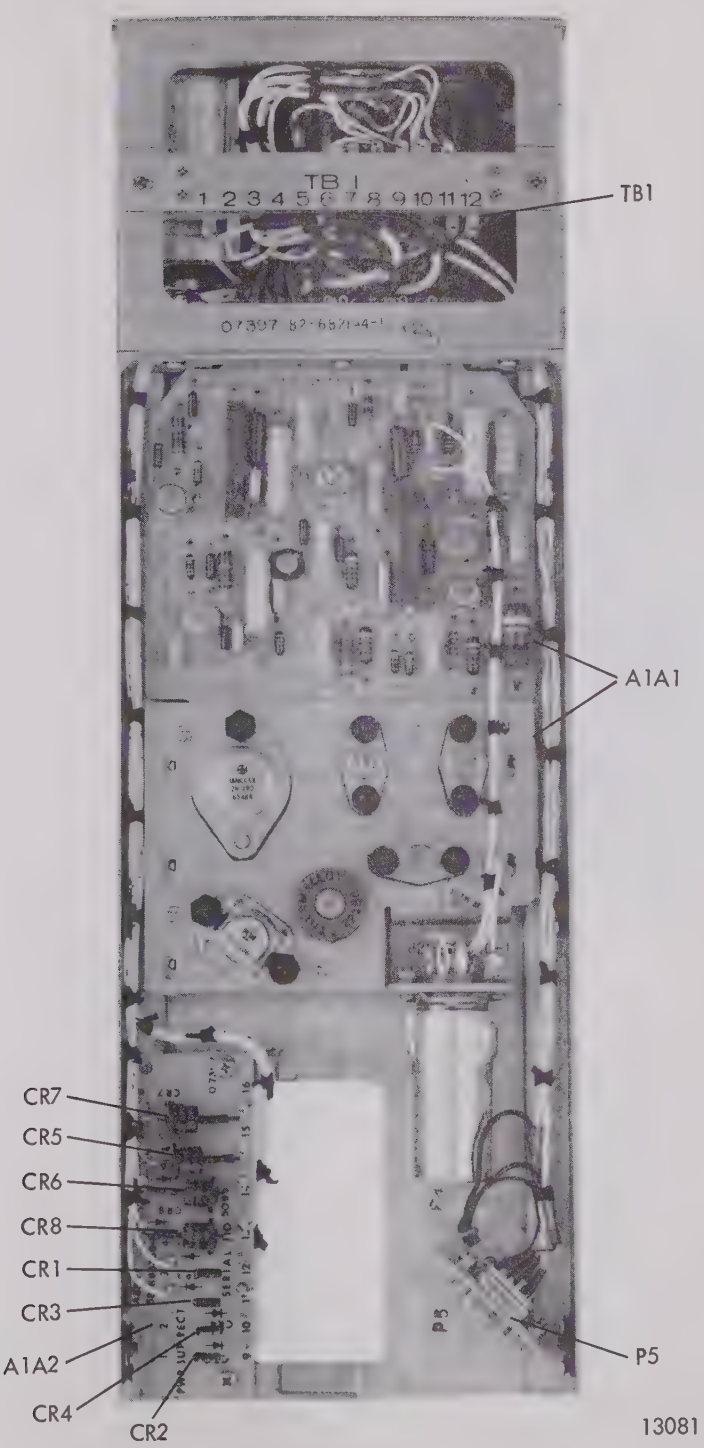
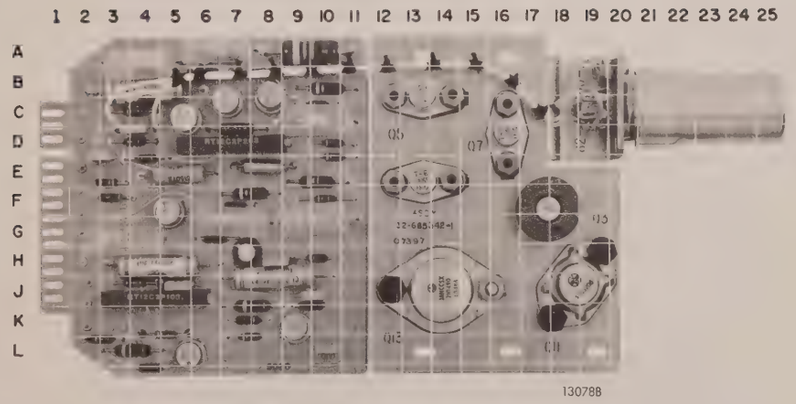


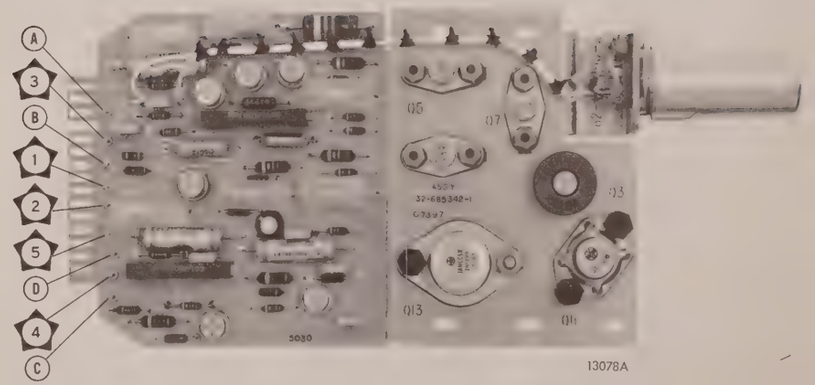
Figure 5-4. Power Supply Assembly (A1), Bottom View

PART LOCATION LIST

PART	LOCATION	PART	LOCATION
C2	H8	Q11	J18
C3	H4	Q12	L5
C4	J5	Q13	J14
C5	J8		
C6	E8	R1	E3
C7	B4	R2	E10
C8	D2	R3	F7
C9	D4	R4	F10
C10	C18	R5	H10
C11	J10	R6	J4
C12	L10	R7	J4
		R8	E5
CR1	F3	R9	A10
CR2	F7	R10	B10
CR3	G9	R11	B6
CR4	G7	R12	C10
CR5	G6	R13	D10
CR6	G3	R14	E10
CR7	A7	R15	D7
CR8	A4	R16	D7
CR9	B10	R17	E4
CR10	B8	R18	C4
CR11	C10	R19	D4
CR12	K7	R20	J7
CR13	K9	R21	L7
CR14	L3	R22	L4
CR15	M4	R23	K5
Q1	E13	V1	C22
Q2	F5		
Q3	F17	TP1	K2
Q4	H7	TP2	J2
Q5	C13	TP3	J2
Q6	B8	TP4	H2
Q7	D16	TP5	G2
Q8	C7	TP6	F2
Q9	C5	TP7	F2
Q10	K9	TP8	E2
		TP9	D2



(b) Test-Point Locations



(a) Component Locations

Figure 5-5. Voltage Regulator Board (A1A1), Component and Test Point Locations

Figure 5-6. Display Assembly (A2), Top View Showing External Adjustments

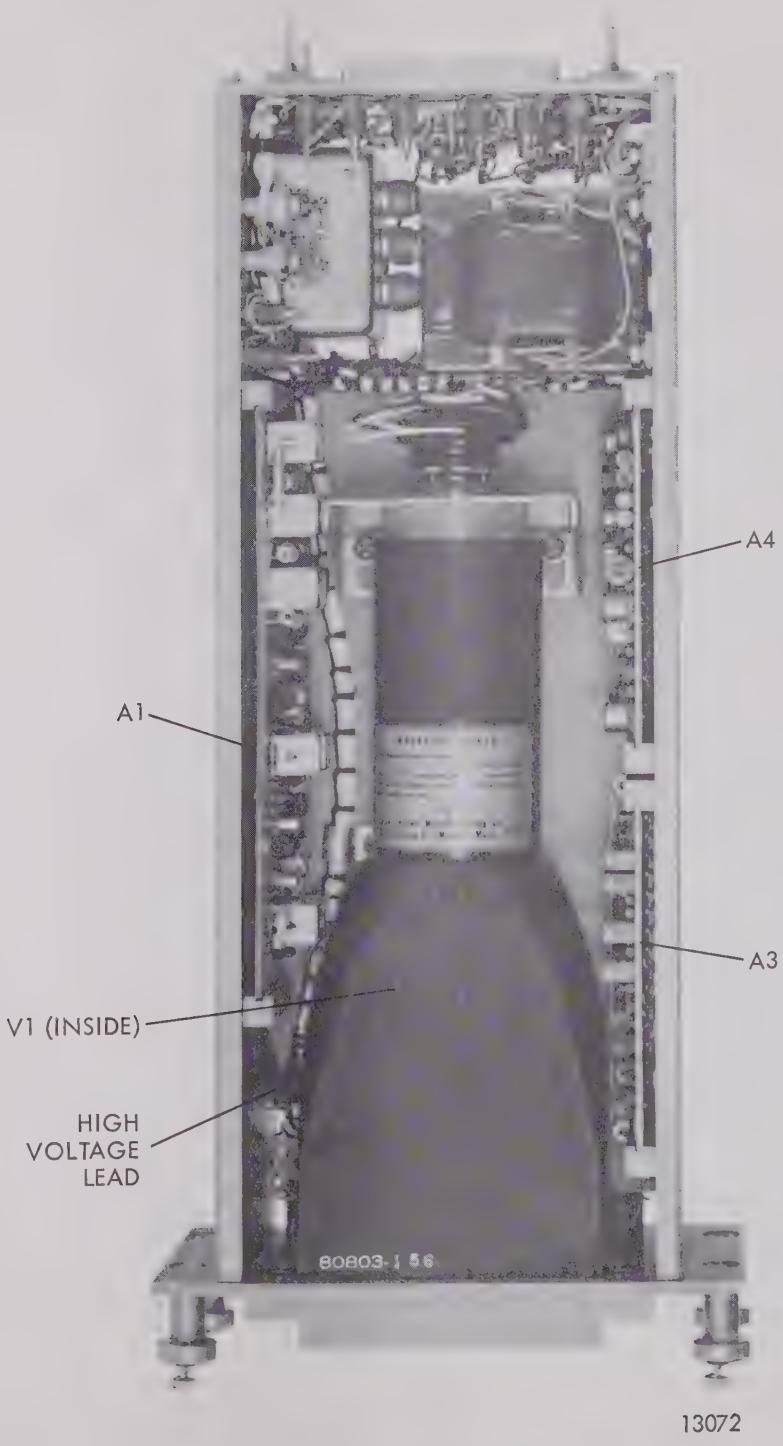


Figure 5-7. Display Assembly (A2), Top View, Subassembly Locations

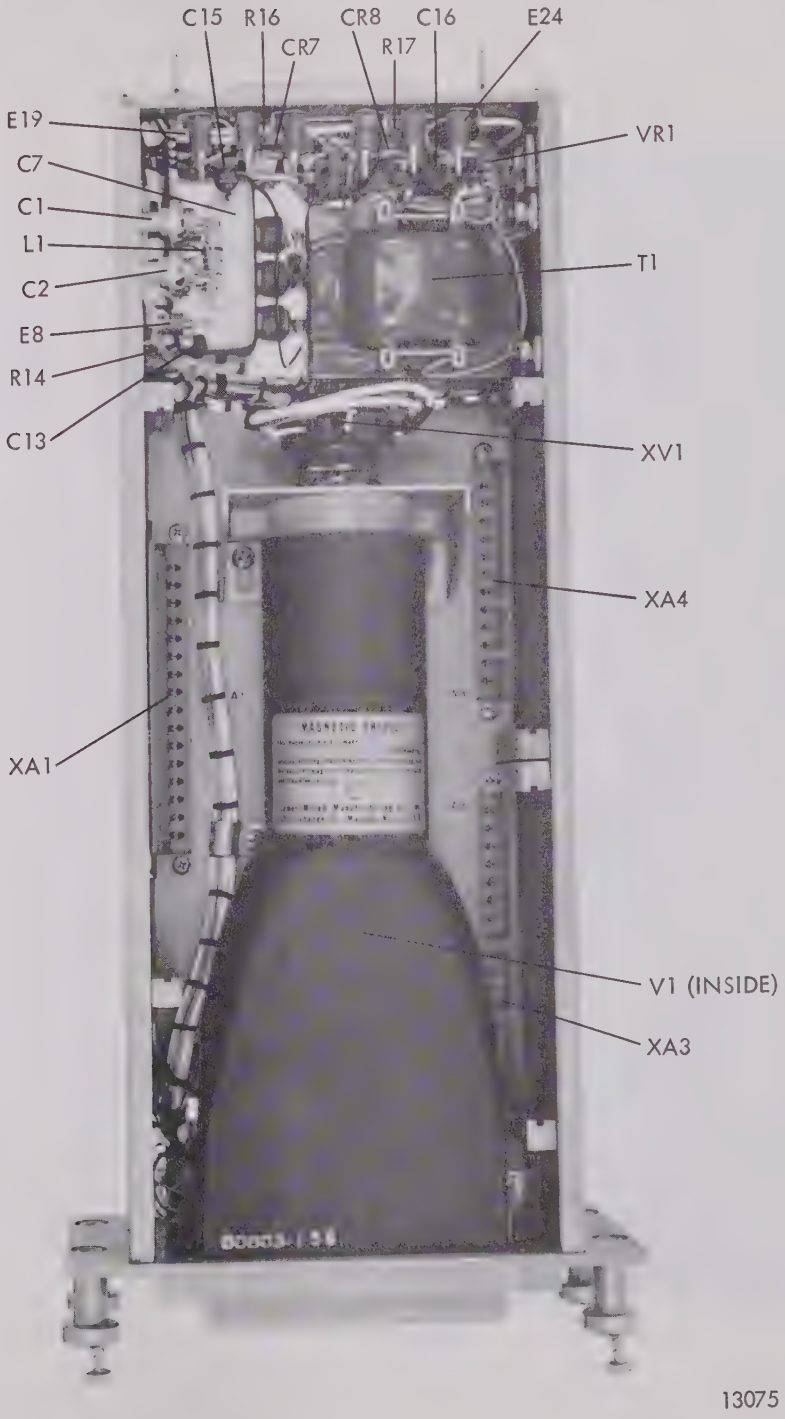
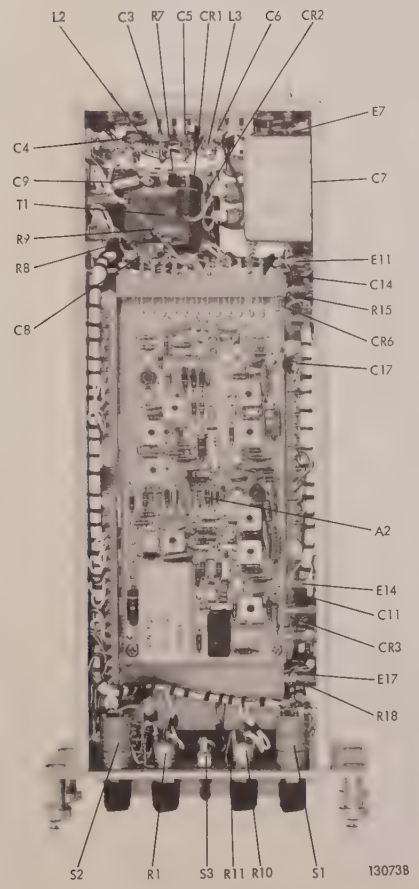


Figure 5-8. Display Assembly (A2), Top View, Component Locations



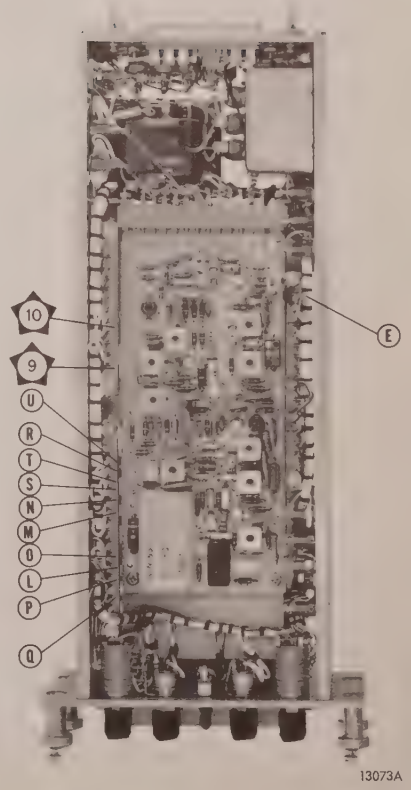


Figure 5-9. Display Assembly (A2), Bottom View, Component and Test Point Locations

PART LOCATION LIST

PART	LOCATION	PART	LOCATION
C1	Y4	L5	V5
C2	Y6	L6	S5
C3	W5	L7	K7
C4	W9	L8	L5
C5	V6	L9	C8
C6	W8	L10	C5
C7	T7		
C8	Q9	Q1	O7
C9	S6	Q2	M7
C10	T5	Q3	G7
C11	S4	Q4	E7
C12	Q5		
C13	Q4	R1	T4
C14	P9	R2	V3
C15	O4	R3	X5
C16	N4	R4	P5
C17	N9	R5	P7
C18	N8	R6	O5
C19	J6	R7	O5
C20	M5	R8	O9
C21	N5	R9	N6
C22	M8	R10	K9
C23	J4	R11	J9
C24	G5	R12	P9
C25	E9	R13	L4
C26	F8	R14	H9
C27	F6	R15	J6
C28	B7	R16	J8
C29	C9	R17	G5
C30	E5	R18	H5
C31	B5	R19	H8
C32	E5	R20	F6
C33	H4	R21	B9
		R22	C9
L1	Y5	R23	C4
L2	Y8	R24	E4
L3	V8	R25	E4
L4	S8		

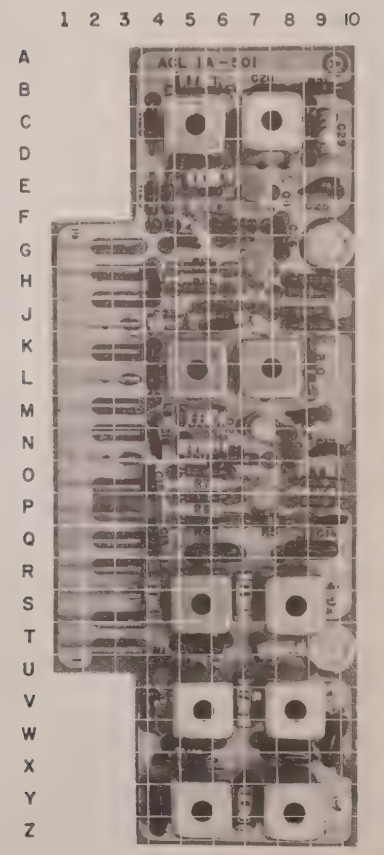
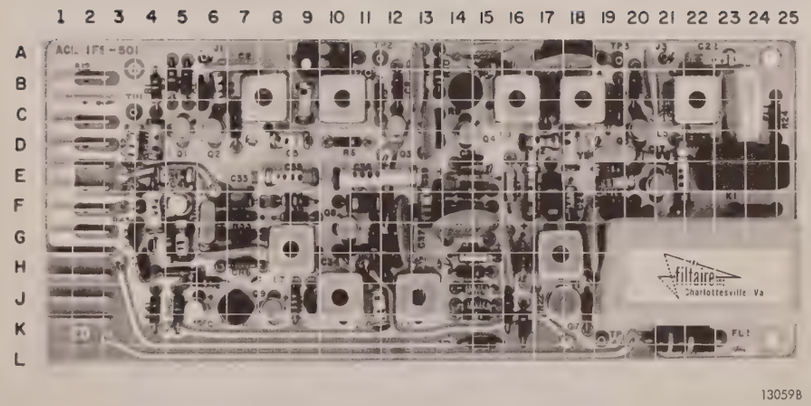


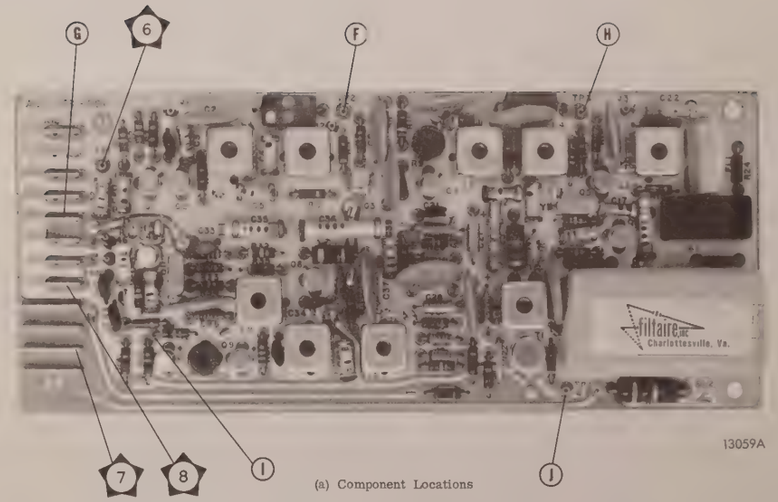
Figure 5-10. Input Amplifier Board (A2A1), Component Locations

PART LOCATION LIST

PART	LOCATION	PART	LOCATION	PART	LOCATION	PART	LOCATION
C1	B5	C38	G7	Q1	C5	R24	C24
C2	A7	C39	F13	Q2	C6	R25	F13
C3	B6	C40	D4	Q3	C12	R26	J16
C4	C13	C41	J11	Q4	C14	R27	K15
C5	D8	C42	J9	Q5	C20	R28	H14
C6	C9	C43	H4	Q6	E21	R29	E14
C7	A10	C44	G5	Q7	J17	R30	J15
C8	B13	C45	F4	Q8	G10	R31	G11
C9	C13	C46	E5	Q9	J8	R32	F9
C10	A15	C47	G3	Q10	J5	R33	F7
C11	A17			Q11	F5	R34	G7
C12	D17	CR1	F14			R35	F9
C13	D18	CR2	F14	R1	B4	R36	G12
C14	A15	CR3	J15	R2	B4	R37	J9
C15	A18	CR4	J15	R3	B5	R38	H12
C16	E19	CR5	F7	R4	C7	R39	J7
C17	D20	CR6	H7	R5	B11	R40	H5
C18	E21			R6	D10	R41	J4
C19	G18	FL1	C23	R7	B12	R42	H6
C20	B20	FL2	H22	R8	B13	R43	J5
C21	D14			R9	B14	R44	G5
C22	A22	J1	A6	R10	B13	R45	F3
C24	H16	J2	A11	R11	C17	R46	E3
C25	E16	J3	A21	R12	C19	R47	K21
C26	F18			R13	B19		
C27	E16	K1	E23	R14	B20	T1	H17
C28	G14			R15	E19		
C29	E14	L1	B8	R16	F19	TP1	C3
C30	H16	L2	B10	R17	F20	TP2	A11
C31	H14	L3	B16	R18	D22	TP3	A19
C32	D3	L4	B18	R19	B22	TP4	K19
C33	F7	L5	B22	R20	J18		
C34	G10	L6	F17	R21	K16	Y1	D19
C35	E8	L7	G8	R22	J16	Y2	F6
C36	E11	L8	F11	R23	F24		
C37	G12	L9	J13				
		L10	J10				



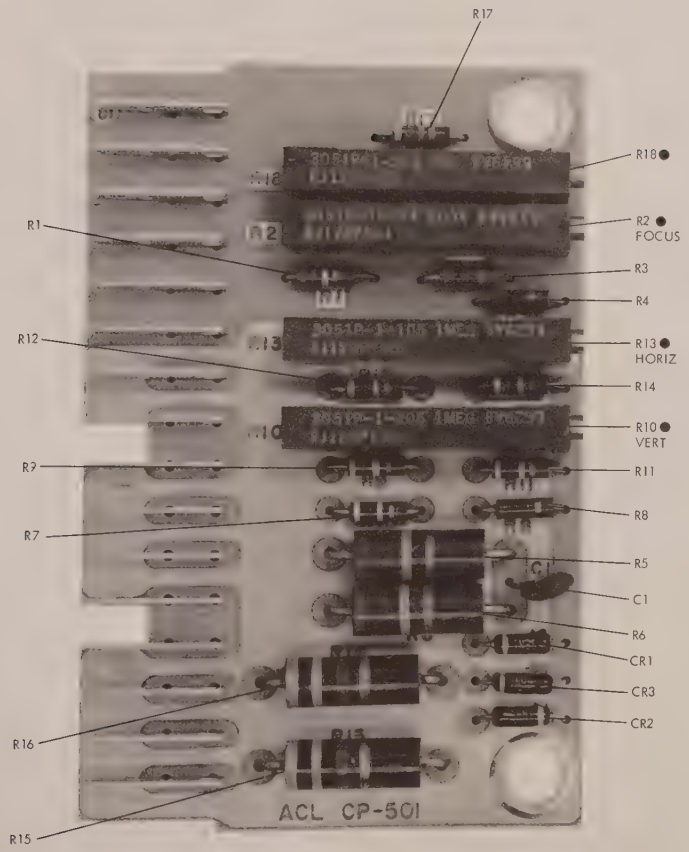
(b) Test-Point Locations



(a) Component Locations

Figure 5-11. IF Amplifier and Sweep Oscillator Board (A2A2), Component and Test Point Locations

NAVSHIPS 0967-207-3320
NAVSHIPS 0967-207-3320



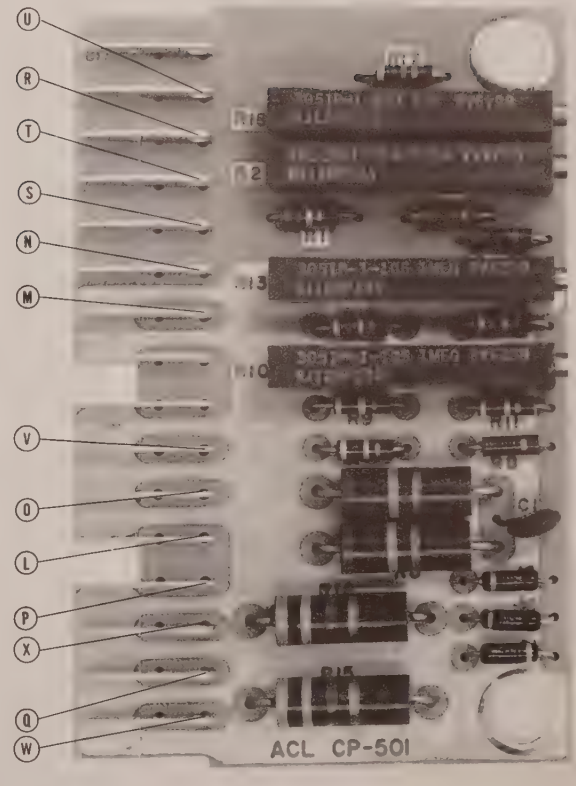
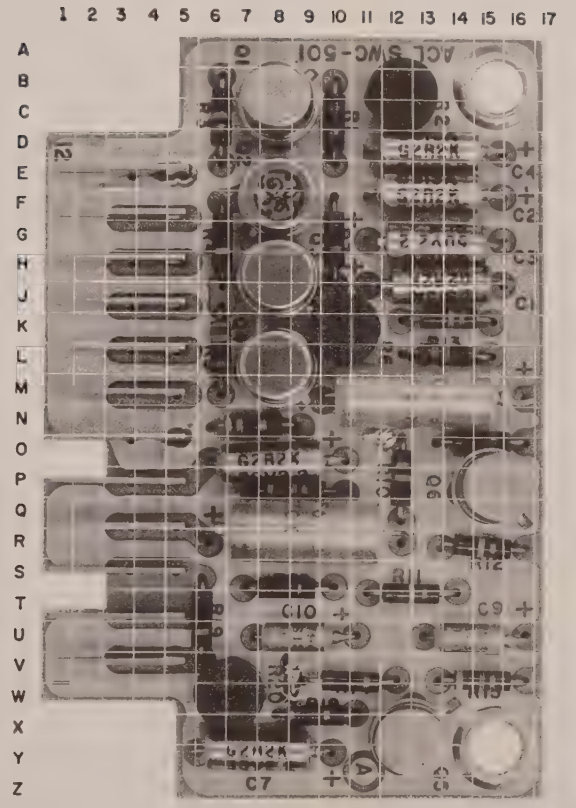


Figure 5-12. Control Potentiometer Board (A2A3), Component and Test Point Locations

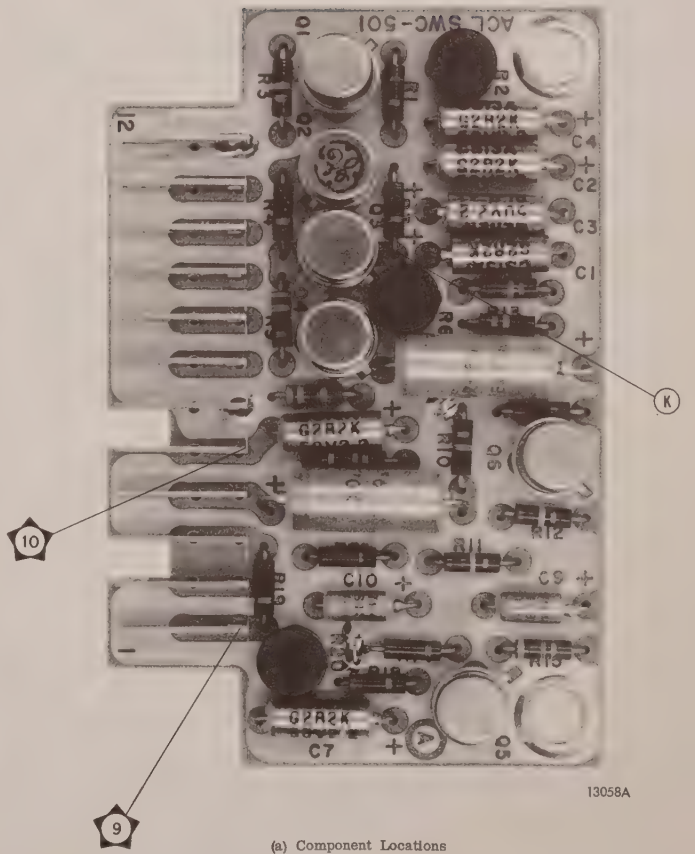
NAVSHIPS 0967-207-3320

PART LOCATION LIST

PART	LOCATION
C1	J13
C2	F13
C3	G13
C4	D13
C5	R9
C6	M13
C7	Y7
C8	O8
C9	U13
C10	U9
Q1	B8
Q2	F8
Q3	H8
Q4	L8
Q5	X13
Q6	P15
R1	C10
R2	B12 SWEEP RATE
R3	C6
R4	G6
R5	K14
R6	K10 GAIN
R7	G10
R8	N7
R9	L6
R10	P12
R11	T12
R12	R15
R13	L14
R14	V10
R15	W15
R16	P9
R17	O15
R18	X9
R19	T6
R20	W6 MAX. SWEEP
R21	S7



(b) Test-Point Locations



(a) Component Locations

Figure 5-13. Sweep Generator Board (A2A4), Component and Test Point Locations

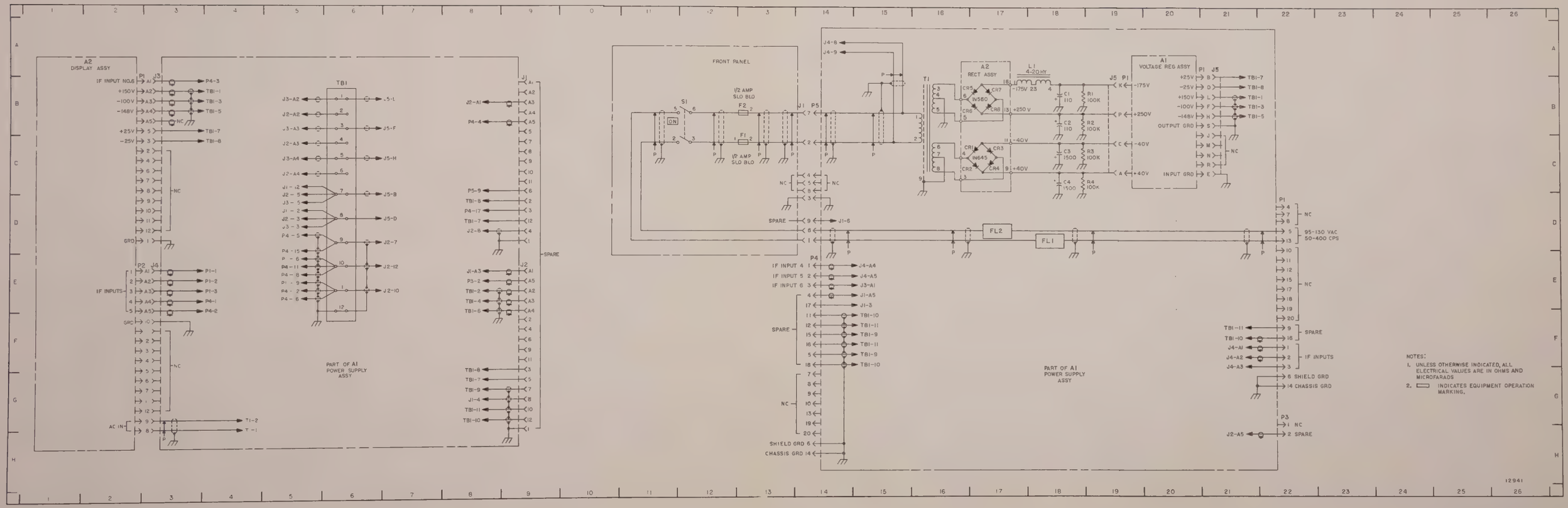


Figure 5-15. Spectrum Display Unit Interconnection Diagram

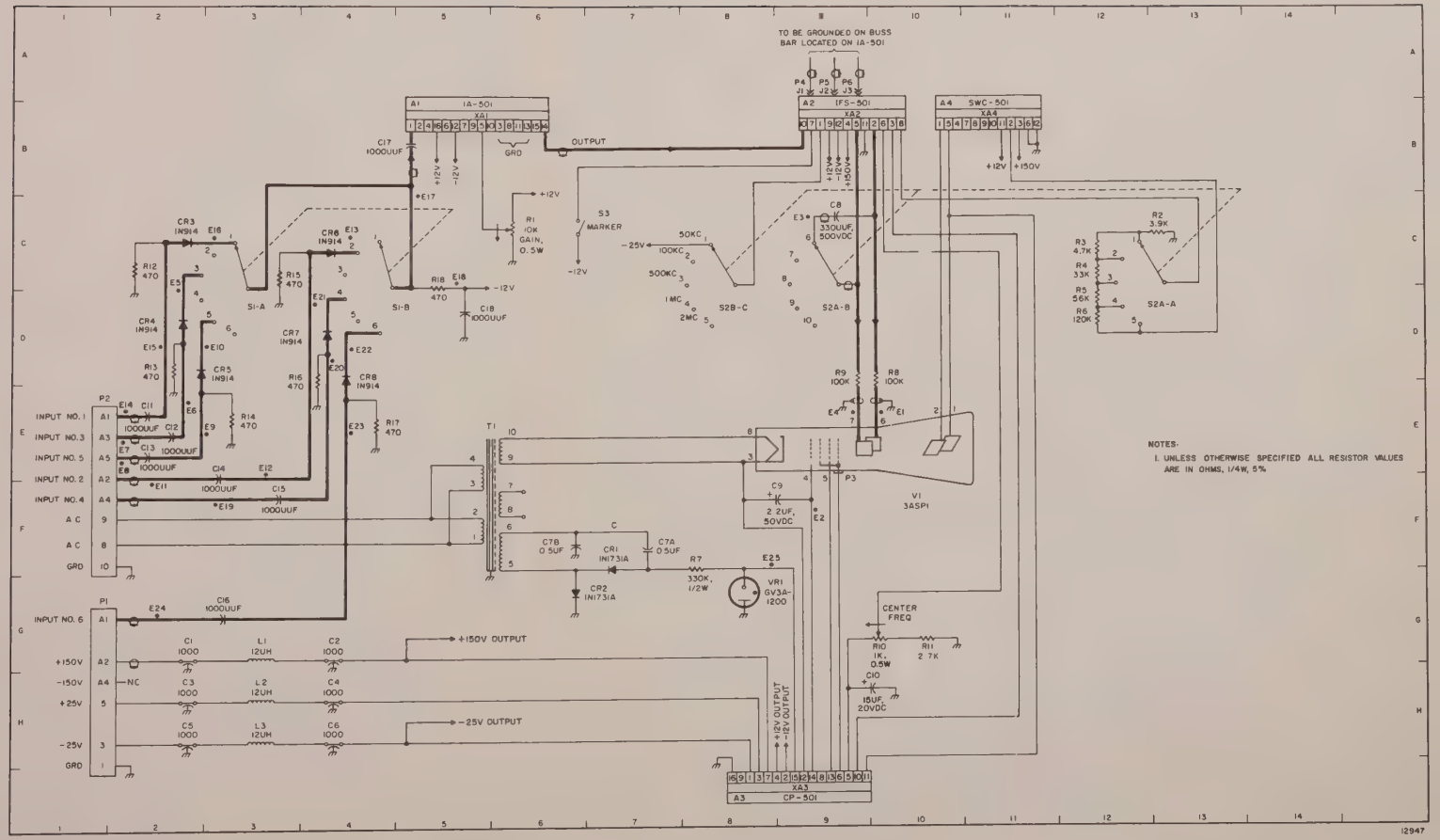


Figure 5-16. Display Assembly (A2), Interconnection Diagram

PART LOCATION INDEX					
REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C2	10B	CR14	3G	R9	4D
C3	12B	CR15	4H	R10	6D
C4	13B			R11	7E
C5	14A	Q1	5A	R12	7D
C6	9D	Q2	7B	R13	8D
C7	11E	Q3	8A	R14	9E
C8	14D	Q4	10B	R15	10E
C9	14F	Q5	5D	R16	10E
C10	14F	Q6	7E	R17	11E
C11	8G	Q7	9D	R18	12F
C12	8G	Q8	9E	R19	13E
CR1	4B	Q9	12F	R20	5F
CR2	6B	Q10	6F	R21	6F
CR3	8A	Q11	6F	R22	3H
CR4	9A	Q12	4H	R23	4G
CR5	11C	Q13	4G	TP1	3G
CR6	11B	R1	4A	TP2	14G
CR7	5D	R2	5B	TP3	3E
CR8	5E	R3	6B	TP4	14F
CR9	6D	R4	7A	TP5	14B
CR10	7D	R5	9B	TP6	14A
CR11	9D	R6	11B	TP7	3A
CR12	5F	R7	12B	TP8	14C
CR13	6G	R8	13C	TP9	3C
				V1	13F

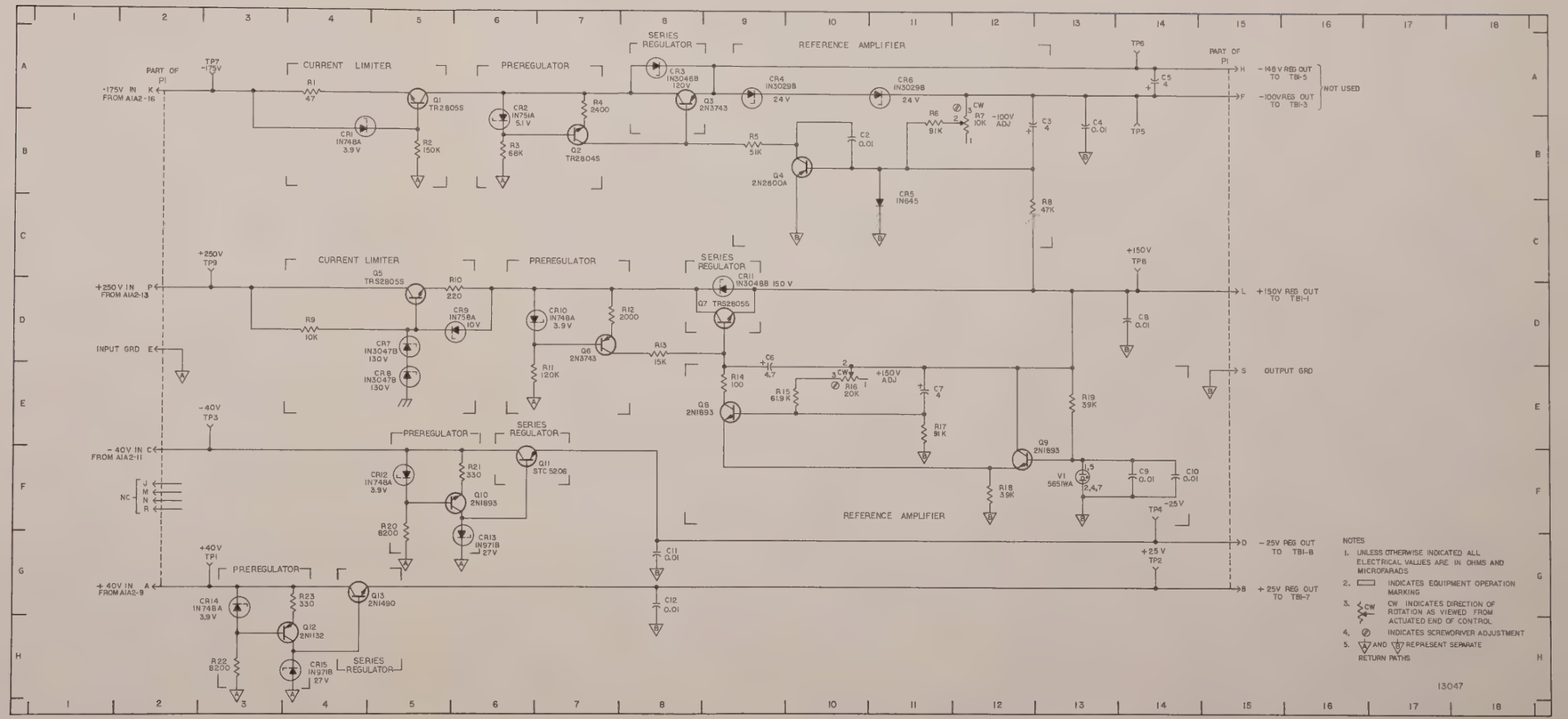
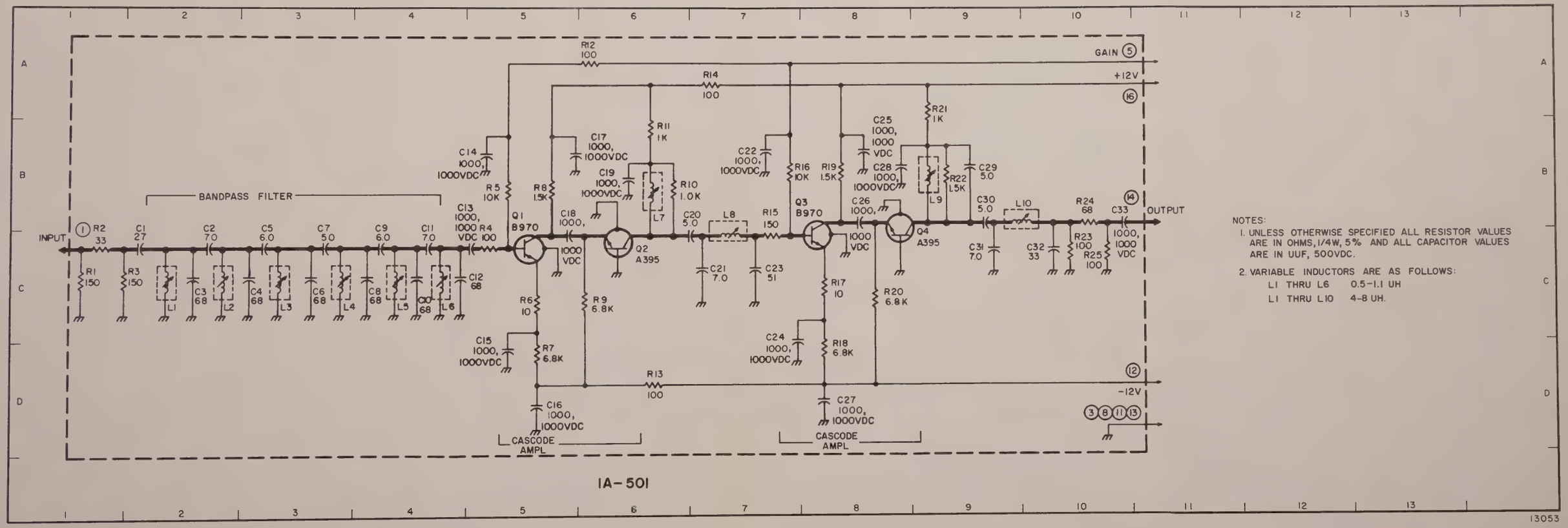


Figure 5-17. Voltage Regulator Board (A1A1), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5% AND ALL CAPACITOR VALUES ARE IN UUF, 500VDC.
2. VARIABLE INDUCTORS ARE AS FOLLOWS:
   L1 THRU L6 0.5-1.1 UH
   L1 THRU L10 4-8 UH.

Figure 5-18. Input Amplifier Board (A2A1), Schematic Diagram

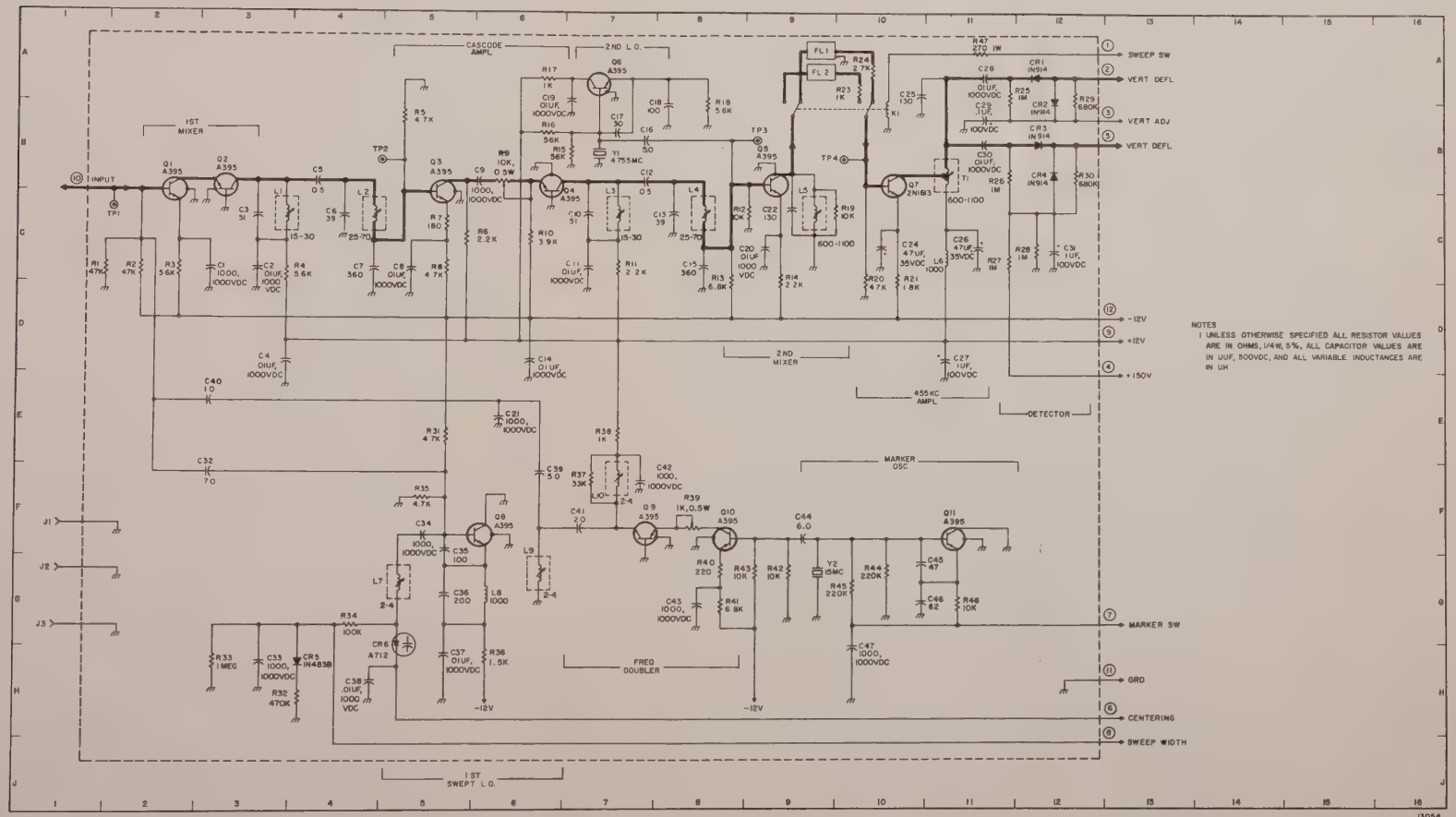


Figure 5-19. IF Amplifier and Sweep Oscillator Board (A2A2), Schematic Diagram

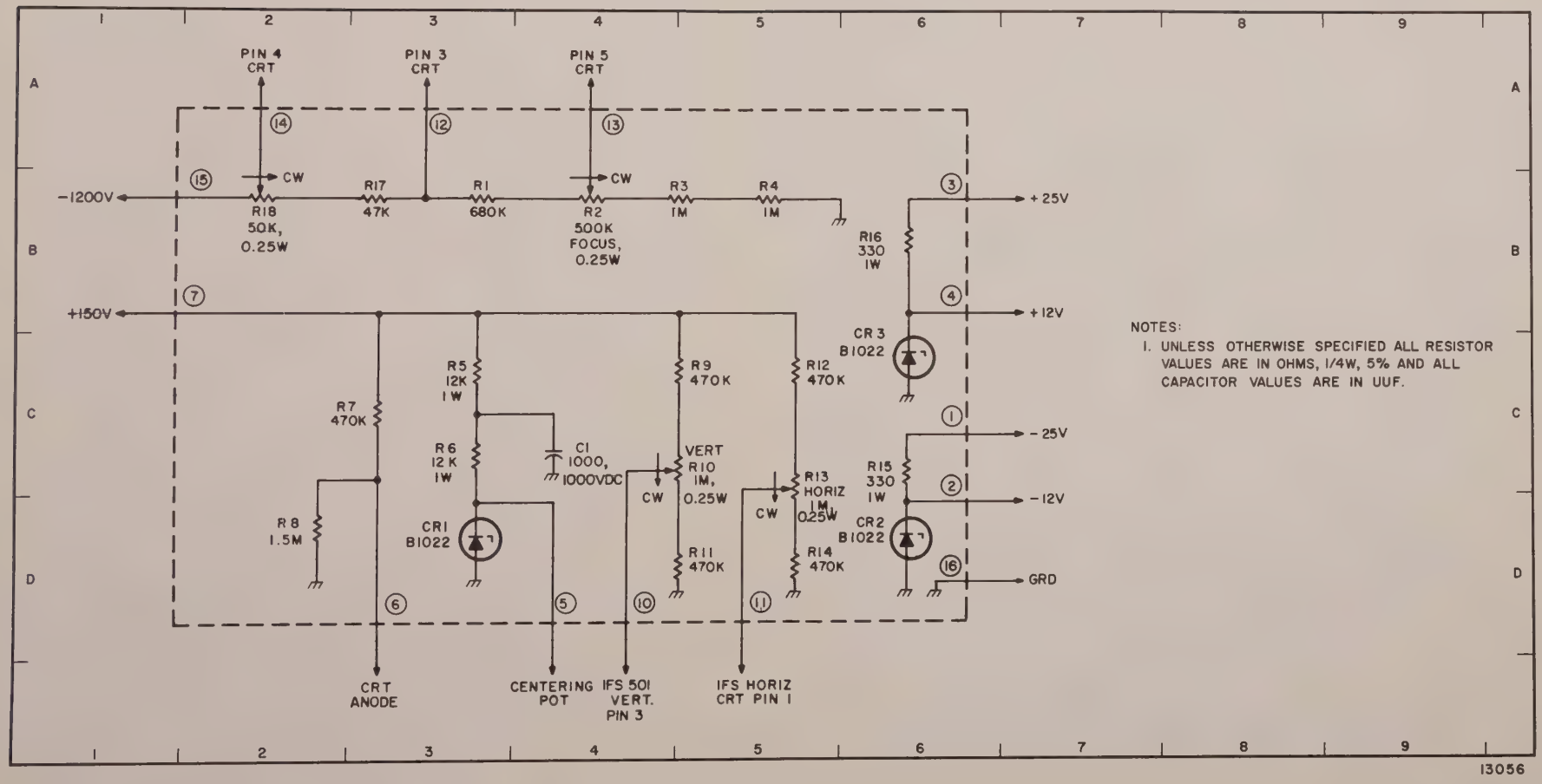


Figure 5-20. Control Potentiometer Board (A2A3), Schematic Diagram

NAVSHIPS 0967-207-3320

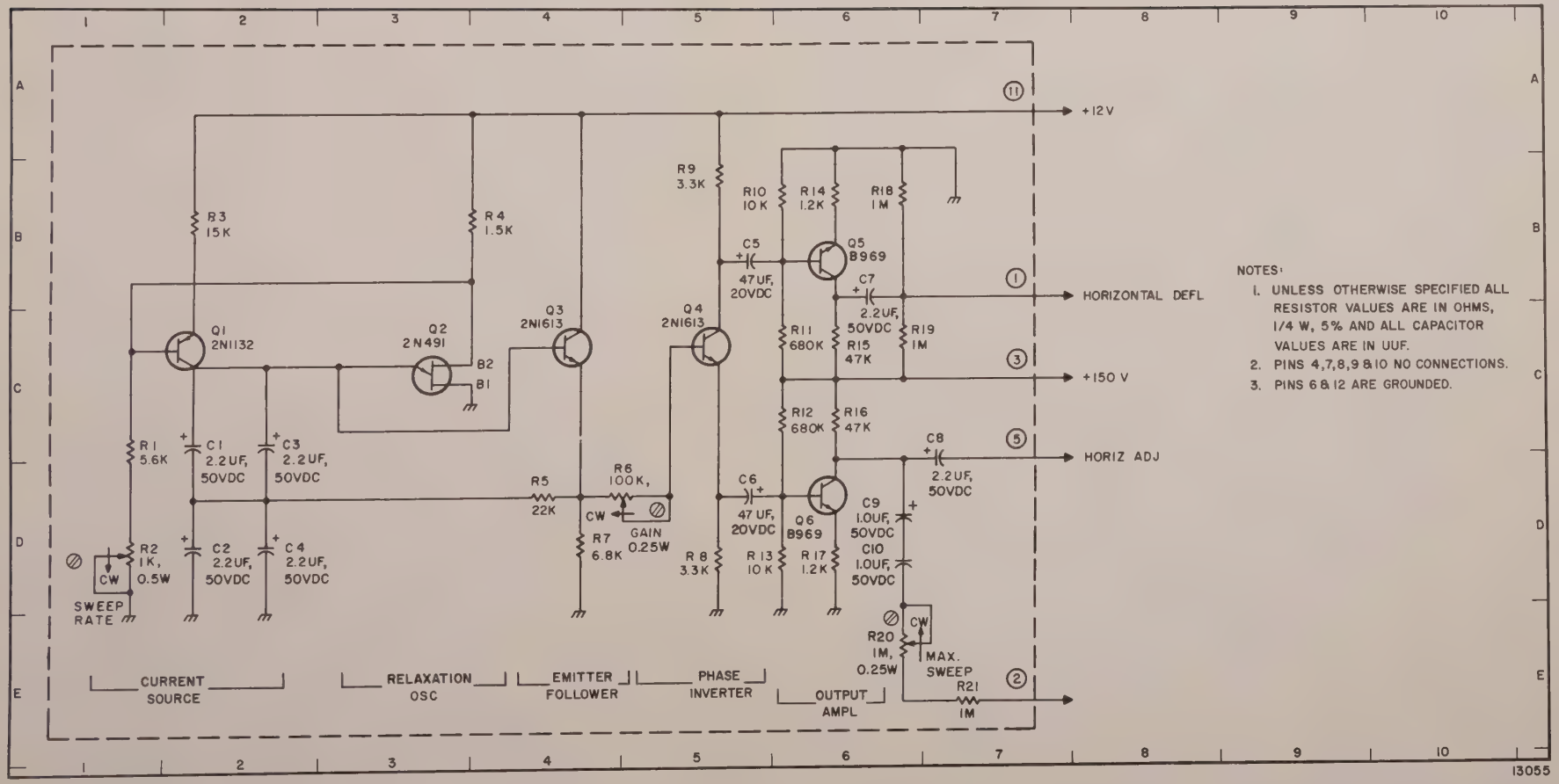


Figure 5-21. Sweep Generator Board (A2A4), Schematic Diagram

SECTION 6

PARTS LIST

6-1. SCOPE.

6-2. This section contains a list of manufacturers and a parts list for Spectrum Analyzer TS-2332/WLR-6(V).

6-3. LIST OF MANUFACTURERS.

6-4. Table 6-1 lists the manufacturers of nonstandard items, and the applicable standards or specifications for standard items by code number. The code number for each item is given in the parts list.

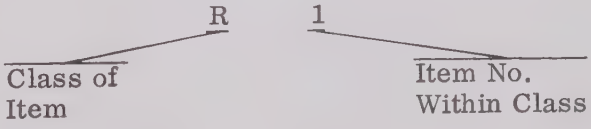
6-5. PARTS LIST.

6-6. Units, assemblies, subassemblies, and parts are listed by their reference symbols, manufacturer's code, and part number in the parts list. The parts list includes a complete description of each item.

6-7. REFERENCE SYMBOLS.

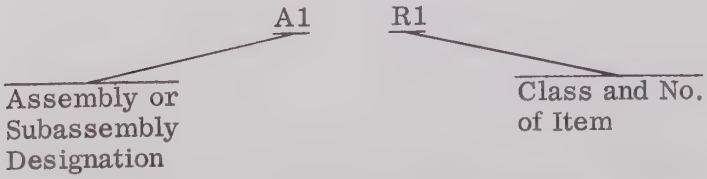
6-8. The unit numbering method of assigning reference symbols has been used to identify assemblies, subassemblies, and parts of units. This method has been expanded as much as necessary to adequately identify the various subdivisions of each unit. Typical expansions of the unit numbering method are shown in the following examples.

Example 1:



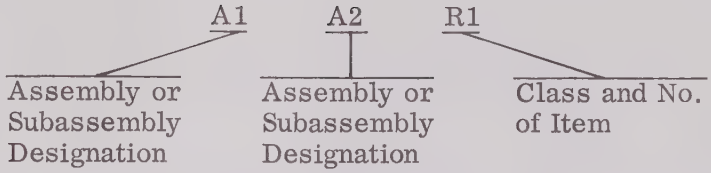
Read as: First (1) resistor (R)

Example 2:



Read as: First (1) resistor (R) or first (1) assembly or subassembly.

Example 3:



Read as: First (1) resistor (R) of second (2) assembly or subassembly (A) of first (1) assembly of subassembly (A).

6-9. STOCK NUMBERS.

6-10. A manufacturer's stock number is assigned to each nonstandard item in the parts list and a Federal Stock Number is assigned to each standard item. Nonstandard parts must be obtained from the manufacturer identified by the manufacturer's code. Standard items may be obtained from any source so long as they meet the specifications identified by the manufacturer's code.

6-11. MANUFACTURER'S CODE.

6-12. A manufacturer's code number is assigned to each standard and nonstandard item in the parts list. The code number for a nonstandard item identifies the manufacturer. The code number for a standard item identifies the standard or specification that sets the physical and electrical requirements for that item. The manufacturers, standards, and specifications are listed by code number in the list of manufactures.

TABLE 6-1. LIST OF MANUFACTURERS

01686	ALVERSON CO.NEW YORK, N Y
02660	AMPHENOL-BORG ELECTRONICS CORP, MAYWOOD, ILL
02777	HOPKINS ENGINEERING CO, SAN FERNANDO, CALIF
06001	GENERAL ELECTRIC CO, CAPACITOR DEPT, IRMO, S C
07256	SILICON TRANSISTOR CORP, CARLE PLACE, NY
07322	MINNESOTA RUBBER CO, 3630 WOODALE AVE, MINNEAPOLIS, MINN
07397	SYLVANIA ELECTRIC PRODUCTS INC, MOUNTAIN VIEW, CALIF
08225	INDUSTRO TRANSISTOR CORP, LONG ISLAND CITY, NY
19905	ASTRO COMMUNICATION LAB DIV AERO GEO ASTRO CORP, GAITHERSBURG, MD
63060	VICTOREEN INSTRUMENT CO INC, 5806 HOUCH AVE, CLEVELAND, OHIO
71279	CAMBRIDGE THERMIONIC CORP, CAMBRIDGE, MASS
71468	ITT CANNON ELECTRIC INC, LOS ANGELES, CALIF
75382	KULKA ELECTRIC CORP, MT VERNON, NY
80008	ELECTRO ENGINEERING WORKS, SAN LEANDRO, CALIF
80131	ELECTRONIC INDUSTRIES ASSOCIATION, WASHINGTON D C
80294	BOURNS INC, RIVERSIDE, CALIF
81349	MILITARY SPECIFICATIONS
82219	SYLVANIA ELECTRIC PRODUCTS INC, EMPORIUM, PA
85323	BALTIMORE TRANSFORMER AND COIL CO, ELKRIDGE, MD
91662	ELCO CORP, WILLOW GROVE, PA
94150	STANDARD CABLE CORP, CHICKASHA, OKLA
96906	MILITARY STANDARD

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
610-1	ANALYZER,SPECTRUM, 20.3 TO 22.5 MC FREQ RANGE, 1 BAND, 1 CHANNEL, 21.4 MC FREQ OF INDIVIDUAL CHANNEL. CRT IF DISPLAY. 95 TO 130 V, 50 TO 400 CPS, 1 PHASE. 19 IN. LG, 6.312 IN. W, 8.719 IN. H O/A DIM. PLUG-IN RACK MTG. JETDS TYPE NO. TS-2332/WLR-6(V). SCHEMATIC DWG NO. 00-684013-1. SYLVANIA PART NO. 02-680610-1	07397	02-680610-1
A1	ANALYZER SUBASSEMBLY, PART OF SYLVANIA ANALYZER, SPECTRUM, JETDS TYPE NO. TS-2332/WLR-6(V), SYLVANIA PART NO. 02-680610-1. 6.312 IN. BY 8.719 IN. BY 19.000 IN. O/A DIM. SCHEMATIC NO. 00-684013-1. SYLVANIA PART NO. 89-684025-1	07397	89-684025-1
A1A1	POWER SUPPLY, PART OF SYLVANIA ANALYZER SUBASSEMBLY PART NO. 89-684025-1. 6.312 IN. BY 8.719 IN. 19.000 IN. O/A DIM. SCHEMATIC NO. 00-684013-1. SYLVANIA PART NO. 89-684009-1	07397	89-684009-1
A1A1A1	REGULATOR,VOLTAGE, ELECTRONIC TYPE W/ELECTRON TUBE AND SOLID STATE DEVICES. -175 VDC, +175 VDC, -40 VDC, AND -40 VDC INPUTS. +150 VDC, -148 VDC, -100 VDC, -25 VDC, AND +25 VDC OUTPUTS. NO ENCLOSURE. 8.592 IN. LG, 4.000 IN. W, 1.031 IN. H O/A DIM. PLUG-IN TYPE MTG. SCHEMATIC DWG NO. 00-685343-1. SYLVANIA PART NO. 32-685342-1	07397	32-685342-1
A1A1A1C2	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 10000 PF, PORM 20 PCT, 200 WVDC. SPEC NO. MIL-C-11015	81349	CK06CW103M
A1A1A1C3	CAPACITOR,FIXED,ELECTROLYTIC, 4 UF, +30 -15 PCT, 150 WVDC. SPEC NO. MIL-C-3965	81349	CL25BQ040SP3
A1A1A1C4	SAME AS A1A1A1C2		
A1A1A1C5	SAME AS A1A1A1C3		
A1A1A1C6	CAPACITOR,FIXED,ELECTROLYTIC, 4.7 UF, PORM 10 PCT, 50 WVDC.	81349	M26655-2-0232

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	SPEC NO. MIL-C-26655		
A1A1A1C7	SAME AS A1A1A1C3		
A1A1A1C8	SAME AS A1A1A1C2		
A1A1A1C9	SAME AS A1A1A1C2		
A1A1A1C10	SAME AS A1A1A1C2		
A1A1A1C11	SAME AS A1A1A1C2		
A1A1A1C12	SAME AS A1A1A1C2		
A1A1A1CR1	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N748A
A1A1A1CR2	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N751A
A1A1A1CR3	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N3046B
A1A1A1CR4	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N3029B
A1A1A1CR5	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N645
A1A1A1CR6	SAME AS A1A1A1CR4		
A1A1A1CR7	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N3047B
A1A1A1CR8	SAME AS A1A1A1CR7		
A1A1A1CR9	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N758A
A1A1A1CR10	SAME AS A1A1A1CR9		
A1A1A1CR11	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N3048B
A1A1A1CR12	SAME AS A1A1A1CR1		
A1A1A1CR13	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N971B
A1A1A1CR14	SAME AS A1A1A1CR1		
A1A1A1CR15	SAME AS A1A1A1CR13		
A1A1A1E1	TERMINAL,LUG, 1 MTG HOLE, NO. 4 STUD ACCOMMODATED, 0.156 IN. FROM CENTER OF HOLE TO END	96906	MS35431-1

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	OF MTG. W/O LOCKING DEVICE. COPPER. TINNED FINISH, 0.625 IN. LG O/A, 0.312 IN. W, 0.018 IN. THK. W/0.093 IN. DIA CONDUCTOR ACCOMMODATION HOLE, SOLDER CONNECTION. MIL STD PART NO. MS35431-1		
A1A1A1Q1	TRANSISTOR, SILICON, NPN JUNCTION CONTACT CONSTRUCTION, 1.003 IN. L BY 0.505 IN. W BY 0.330 IN. H O/A DIM. HERMETICALLY SEALED. 3 WIRE LEAD TERMINALS. INDUSTRO TRANSISTOR CORP PART NO. TRS2805S	08225	TRS2805S
A1A1A1Q2	TRANSISTOR, SILICON, NPN JUNCTION CONTACT CONSTRUCTION, 0.370 IN. DIA BY 0.260 IN. H O/A DIM. HERMETICALLY SEALED. 3 WIRE LEAD TERMINALS. INDUSTRO TRANSISTOR CORP PART NO. TRS2804S	08225	TRS2804S
A1A1A1Q3	TRANSISTOR, SILICON, PNP JUNCTION CONTACT CONSTRUCTION, 0.370 IN. DIA BY 0.260 IN. H O/A DIM. HERMETICALLY SEALED. 3 WIRE LEAD TERMINALS. EIA NO. 2N3743	80131	2N3743
A1A1A1Q4	TRANSISTOR, SILICON. PNP JUNCTION CONTACT CONSTRUCTION. 0.230 IN. DIA BY 0.085 IN. O/A DIM. HERMETICALLY SEALED. 3 WIRE LEAD TERMINALS. EIA NO. 2N2600A	80131	2N2600A
A1A1A1Q5	SAME AS A1A1A1Q1		
A1A1A1Q6	SAME AS A1A1A1Q3		
A1A1A1Q7	SAME AS A1A1A1Q1		
A1A1A1Q8	SAME AS A1A1A1Q2		
A1A1A1Q9	SAME AS A1A1A1Q2		
A1A1A1Q10	TRANSISTOR, SILICON. NPN JUNCTION CONTACT CONSTRUCTION. SPEC NO. MIL-S-19500	81349	JAN2N1893
A1A1A1Q11	TRANSISTOR, SILICON, PNP JUNCTION CONTACT CONSTRUCTION, 0.605 IN. DIA BY 0.310 IN. H O/A DIM. 3 WIRE LEAD TERMINALS HERMETICALLY SEALED. SILICON TRANSISTOR CORP PART NO. STC5206	07256	STC5206

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A1A1A1Q12	TRANSISTOR, SILICON. PNP JUNCTION CONTACT CONSTRUCTION. SPEC NO. MIL-S-19500	81349	JAN2N1132
A1A1A1Q13	TRANSISTOR, SILICON. NPN JUNCTION CONTACT CONSTRUCTION. SPEC NO. MIL-S-19500	81349	JAN2N1490
A1A1A1R1	RESISTOR,FIXED,COMPOSITION, 47 OHMS, PORM 10 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF470K
A1A1A1R2	RESISTOR,FIXED,FILM, 150000 OHMS, PORM 5 PCT, 1/2 W. SPEC NO. MIL-R-22684	81349	M22684-02-0202
A1A1A1R3	RESISTOR,FIXED,FILM, 68000 OHMS, PORM 5 PCT, 1/2 W. SPEC NO. MIL-R-22684	81349	M22684-02-0186
A1A1A1R4	RESISTOR,FIXED,FILM, 2400 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-22684	81349	M22684-01-0082
A1A1A1R5	RESISTOR,FIXED,FILM, 51000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-22684	81349	M22684-01-0146
A1A1A1R6	RESISTOR,FIXED,FILM, 90900 OHMS, PORM 1 PCT, 1/4 W. SPEC NO. MIL-R-10509	81349	RN65E9092F
A1A1A1R7	RESISTOR,VARIABLE, 10000 OHMS, PORM 5 PCT, 3/4 W. SPEC NO. MIL-R-27208	81349	RT12C2P103
A1A1A1R8	RESISTOR,FIXED,FILM, 147000 OHMS, PORM 1 PCT, 1/4 W. SPEC NO. MIL-R-10509	81349	RN65C1473F
A1A1A1R9	RESISTOR,FIXED,FILM, 10000 OHMS, PORM 5 PCT, .2 W. SPEC NO. MIL-R-22684	81349	M22684-04-0146
A1A1A1R10	RESISTOR,FIXED,FILM, 220 OHMS, PORM 5 PCT, 1/2 W. SPEC NO. MIL-R-22684	81349	M22684-02-0066
A1A1A1R11	RESISTOR,FIXED,FILM, 120000 OHMS, PORM 5 PCT, 1/2 W.	81349	M22684-02-0198

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	SPEC NO. MIL-R-22684		
A1A1A1R12	RESISTOR,FIXED,FILM, 5600 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-22684	81349	M22684-01-0100
A1A1A1R13	RESISTOR,FIXED,FILM, 15000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-22684	81349	M22684-01-0120
A1A1A1R14	RESISTOR,FIXED,FILM, 100 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-22684	81349	M22684-01-0016
A1A1A1R15	RESISTOR,FIXED,FILM, 61900 OHMS, PORM 1 PCT, 1/8 W. SPEC NO. MIL-R-10509	81349	RN60C6192F
A1A1A1R16	RESISTOR,VARIABLE, 20000 OHMS, PORM 5 PCT, 3/4 W. SPEC NO. MIL-R-27208	81349	RT12C2P203
A1A1A1R17	SAME AS A1A1A1R6		
A1A1A1R18	RESISTOR,FIXED,FILM, 39000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-22684	81349	M22684-01-0140
A1A1A1R19	SAME AS A1A1A1R18		
A1A1A1R20	RESISTOR,FIXED,FILM, 8200 OHMS, PORM 5 PCT, 1/2 W. SPEC NO. MIL-R-22684	81349	M22684-02-0142
A1A1A1R21	RESISTOR,FIXED,FILM, 330 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-22684	81349	M22684-01-0040
A1A1A1R22	SAME AS A1A1A1R20		
A1A1A1R23	SAME AS A1A1A1R21		
A1A1A1V1	ELECTRON TUBE, GLASS ENVELOPE, VOLTAGE REFERENCE. SPEC NO. MIL-E-1	81349	JAN5651WA
A1A1A1XV1	SOCKET,ELECTRON TUBE, MINIATURE 7 PIN CONTACT CONFIGURATION. SPEC NO. MIL-S-12883	81349	TS102P01

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A1A1A2	SEMICONDUCTOR DEVICE ASSEMBLY,DIODE, 4 DIODES, MIL TYPE NO. JAN1N645 AND 4 DIODES, MIL TYPE NO. JAN1N560. 0.500 IN. BY 1.250 IN. BY 3.490 IN. O/A DIM. SCHEMATIC DWG NO. 00-685359-1. SYLVANIA PART NO. 32-685358-1	07397	32-685358-1
A1A1A2CR1	SAME AS A1A1A1CR5		
A1A1A2CR2	SAME AS A1A1A1CR5		
A1A1A2CR3	SAME AS A1A1A1CR5		
A1A1A2CR4	SAME AS A1A1A1CR5		
A1A1A2CR5	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N560
A1A1A2CR6	SAME AS A1A1A2CR5		
A1A1A2CR7	SAME AS A1A1A2CR5		
A1A1A2CR8	SAME AS A1A1A2CR5		
A1A1C1	CAPACITOR,FIXED,ELECTROLYTIC, TANTALUM TYPE, NONPOLARIZED, PLAIN FOIL, SOLID ELECTROLYTE, ONE SECTION, 110 UF, MINUS 10 PLUS 50 PCT TOLERANCE 350 WVDC, METAL CASE W/PLASTIC SLEEVE, 1.375 IN. DIA BY 2.125 IN. LG, O/A DIM 2 STUD TERMINALS AT ONE END, MTG FACILITIES NOT INCLUDED. GECO CAPACITOR DEPT PART NO. 43F3013MA6	06001	43F3013MA6
A1A1C2	SAME AS A1A1C1		
A1A1C3	CAPACITOR,FIXED,ELECTROLYTIC, 1 SECTION, 75 WVDC, 1500 UF, -10 +100 PCT, -20 TO +65 DEG C, OPERATING TEMP RANGE. INSULATED METAL CASE, HERMETICALLY SEALED. 1.375 IN. DIA BY 4.125 IN. O/A DIM. 2 TAPPED HOLE TYPE W/SCREW TERMINALS. GENERAL ELECTRIC PART NO. 43F3055MA6	06001	43F3055MA6
A1A1C4	CAPACITOR,FIXED,ELECTROLYTIC, TANTALUM TYPE, NONPOLARIZED, PLAIN FOIL, SOLID ELECTROLYTE, ONE SECTION, 500 UF, MINUS 10 PLUS 100 PCT TOLERANCE, 75 WVDC. METAL CASE W/PLASTIC SLEEVE, 1.375 IN. DIA BY 2.125 IN. LG, O/A DIM. 2 STUD TERMINALS AT ONE END. MTG FACILITIES NOT INCL. GECO CAPACITOR DEPT PART NO. 43F3007MA6	06001	43F3007MA6

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A1A1E2	TERMINAL,STUD, BRASS CONDUCTOR, RD SHAPE, THROUGH HOLE TYPE, SPEC NO. MIL-T-55155	81349	SE26XF03
A1A1E3	SAME AS A1A1E2		
A1A1FL1	FILTER,RADIO INTERFERENCE, 120 VAC, 3 AMP, METAL CASE, 1.872 IN. LG, 1.343 IN. W, 0.400 IN. H O/A DIM. BRACKET MTD, TWO 0.171 IN. DIA MTG HOLES SPACED 1.560 IN. C TO C. 2 SOLDER LUG TERMINALS. HOPKINS ENGINEERING PART NO. F3138	02777	F3138
A1A1FL2	SAME AS A1A1FL1		
A1A1L1	REACTOR, SWINGING INDUCTANCE TYPE, 1 COIL, 4.000 TO 20.000 HENRY INDUCTANCE, 0.040 TO 0.004 AMP, 130 OHMS. DOUBLE SHELL, PARTIALLY INCLOSED PLASTIC CASE, 2.000 IN. LG, 1.880 IN. W, 2.500 IN. H BODY DIM. FOUR NO. 4-40 THD MTG HOLES ON 0.750 IN. BY 1.531 IN. MTG CENTERS, TWO SOLDER LUG TERMINALS. ELECTRO ENG WORKS PART NO. E14960	80008	E14960
A1A1R1	RESISTOR,FIXED,COMPOSITION, 82000 OHMS, PORM 10 PCT, 1/4 W. INSULATED WIRE LEAD TERMINALS, W/SOLDER LUG TERMINATIONS. 0.880 IN. LG BY 0.940 IN. W BY 0.090 IN. H, O/A DIM, INCLUDING TERMINALS. SYLVANIA PART NO. 89-684031-2	07397	89-684031-2
A1A1R2	SAME AS A1A1R1		
A1A1R3	SAME AS A1A1R1		
A1A1R4	RESISTOR,FIXED,COMPOSITION, 100000 OHMS, PORM 10 PCT, 1/2 W, INSULATED WIRE LEAD TERMINALS, W/SOLDER LUG TERMINATIONS. 0.880 IN. LG BY 0.940 IN. W BY 0.090 IN. H, O/A DIM, INCLUDING TERMINALS. SYLVANIA PART NO. 89-68031-1	07397	89-684031-1
A1A1T1	TRANSFORMER,POWER,STEP-DOWN*STEP-UP, PARTIALLY INCLOSED, DOUBLE SHELL PLASTIC CASE, 115 V, 50 TO 400 CPS, SINGLE PHASE PRIMARY, 82 VCT, 318 MA,	80008	E14959

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	464 VCT, 64 MA SECONDARIES. 3.120 IN. LG, 2.620 IN. W, 2.870 IN. H BODY DIM. 9 SOLDER LUG TERMINALS. 4 NO. 4-40 THD MTG HOLES ON 1.720 IN. BY 1.940 IN. MTG CENTERS. INTERNAL SHIELD TO TERMINAL. ELECTRO ENG WORKS PART NO. E14959		
A1A1TB1	TERMINAL BOARD, PLASTIC BOARD, MIL-P-19833, TYPE GDI-30F. 12 DOUBLE SCREW TERMINALS. BARRIER TYPE. 3.500 IN. LG, 0.625 IN. W, 0.312 IN. H BOARD DIM. FOUR 0.125 IN. DIA MTG HOLES ON 0.250 IN. BY 3.250 IN. MTG CENTERS. KULKA ELECTRIC PART NO. 410JJ12	75382	410JJ12
A1A1W1	CABLE ASSEMBLY,RADIO FREQUENCY, RG-223/U COAXIAL CABLE. APPROX 4.750 IN. LG O/A, APPROX 3.875 IN. LG, EXCL TERMINATIONS, 0.216 IN. DIA O/A CABLE. 1 ITT CANNON RECEPTACLE ON 1ST END, PART NO. DPGC2E34PA. 1 ITT CANNON CONTACT ON 2ND END, PART NO. DM53743-5004. SYLVANIA PART NO. 73-684026-1	07397	73-684026-1
A1A1W1MP1	CONTACT,ELECTRICAL, GOLD-PLATED OVER SILVER-PLATED PHOSPHOR BRONZE CONTACTS, 0.734 IN. LG, 0.531 IN. W, 0.156 IN. H. 1 KV AC, 1 RIGHT ANGLE SOLDER CUP TERMINAL LOCATED AT ONE END. CANNON ELECTRIC PART NO. DM53743-5051	71468	DM53743-5051
A1A1W1P3	CONNECTOR ASSEMBLY,ELECTRICAL, TWO COAXIAL CONNECTORS. 2.438 IN. LG BY 1.000 IN. W BY 1.500 IN. H, O/A DIM. TWO 6-32 THD MTG NUTS SPACED 2.004 IN. BY 0.566 IN. C TO C. ITT CANNON ELECTRIC PART NO. DPGC2E34PA INC. PART NO. DPGC2E34PA	71468	DPGC2E34PA
A1A1W2	CABLE ASSEMBLY,RADIO FREQUENCY, RG-188A/U COAXIAL CABLE. APPROX 3.000 IN. LG O/A, APPROX 2.250 IN. LG, EXCL TERMINATIONS, 0.110 IN. DIA O/A CABLE. 1 ITT CANNON CONTACT ON EACH END, PART NO. DM53743-5001. MARKED J2A1 AND J1A3. SYLVANIA PART NO. 73-684033-1	07397	73-684033-1

REFERENCE SYMBOL		NAME AND DESCRIPTION	FSMC	PART NUMBER
A1A1W2MP1		CONTACT,ELECTRICAL, GOLD-PLATED OVER SILVER-PLATED BRASS CONTACTS, 0.734 IN. LG, 0.648 IN. W, 0.218 IN. H, 1 KV AC. ONE RIGHT ANGLE SOLDER CUP TERMINAL LOCATED AT ONE END. ITT CANNON ELECTRIC INC PART NO. DM53743-5001	71468	DM53743-5001
A1A1W2MP2		SAME AS A1A1W2MP1		
A1A1	J1	CONNECTOR,RECEPTACLE,ELECTRICAL, 17 FEMALE CONTACTS, 1 CONNECTOR MATING END, 7.5 AMPS, 550 VDC, ARC RESISTANT PLASTIC DIELECTRIC, STRAIGHT SHAPE, 2.729 IN. LG BY 0.494 IN. W BY 0.426 IN. H, O/A DIM. W/INCLOSING STEEL SHELL, CORROSION RESISTANT, POLARIZED, NONLOCKING TYPE, TWO 0.120 IN. DIA MTG HOLES SPACED 2.500 IN. C TO C. ITT CANNON ELECTRIC PART NO. DCM17W5SNMB	71468	DCM17W5SNMB
A1A1	J2	SAME AS A1A1 J1		
A1A1	J3	SAME AS A1A1 J1		
A1A1	J4	SAME AS A1A1 J1		
A1A1	J5	CONNECTOR,RECEPTACLE,ELECTRICAL, 15 FEMALE CONTACTS, 5 AMP., SPEC NO. MIL-C-21097	81349	M21097-1-079
A1A1	P1	CONNECTOR,RECEPTACLE,ELECTRICAL, 20 MALE CONTACTS, ONE CONNECTOR MATING END. ARC RESISTANT PLASTIC DIELECTRIC. STRAIGHT SHAPE. 2.50 IN. LG BY 0.908 IN. W BY 1.225 IN. H, O/A DIM. ALUMINUM ALLOY INCLOSING SHELL. POLARIZED. THD STUD LOCKING TYPE. TWO 6-32 THD MTG STUDS. ITT CANNON ELECTRIC CO. PART NO. DPGM20C4-34PA	71468	DPGM20C4-34PA
A1A1	P4	SAME AS A1A1 P1		
A1A1	P5	CONNECTOR,RECEPTACLE,ELECTRICAL, 9 FEMALE CONTACTS, 1 CONNECTOR MATING END, 7.5 AMPS, 550 VDC. ARC RESISTANT PLASTIC DIELECTRIC, STRAIGHT SHAPE, 1.213 IN. LG BY 0.494 IN. W BY 0.429 IN. H, O/A DIM. W/INCLOSING STEEL SHELL, CORROSION RESISTANT. POLARIZED. NONLOCKING TYPE. TWO 0.120 IN. DIA MTG HOLES SPACED 0.984 IN. C TO C.	02660	17-81090

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	AMPHENOL-BORG ELECTRONICS NO. 17-81090		
A1A2	CHASSIS,ELECTRICAL EQUIPMENT, ALUMINUM, 6.312 IN. BY 8.719 IN. BY 19.000 IN. O/A DIM. PART OF SYLVANIA ANALYZER SUBASSEMBLY, PART NO. 89-684025-1, SYLVANIA PART NO. 89-684007-1	07397	89-684007-1
A1A2F1	FUSE,CARTRIDGE, 1/2 AMP, 250 V, TIME DELAY. SPEC NO. MIL-F-15160	81349	F02B250V1-2A
A1A2F2	SAME AS A1A2F1		
A1A2MP1	BOOT,DUST AND MOISTURE SEAL, SILICONE RUBBER, TYPE A, STYLE 3. SPEC NO. MIL-B-5423	81349	MILB5423-2
A1A2MP2	PACKING,PREFORMED, RUBBER, AMS 7272, STYLE NO. 1 SECT A RDG 76. 0.494 MAX INSIDE DIA, 0.073 MAX THICKNESS. MIL STD PART NO. MS9241-014	96906	MS9241-014
A1A2S1	SWITCH,TOGGLE, DPST, AC/DC, 125 V MAX, 1 AMP NOM CURRENT RATING, 1.169 IN. LG, 0.546 IN. W, 0.562 IN. H, O/A DIM. LEVER TYPE. 6 SOLDER LUG TYPE TERMINALS. MIL-STD PART NO. MS90311-221	96906	MS90311-221
A1A2XF1	FUSEHOLDER, 20 AMPS, 250 V. SPEC NO. MIL-F-19207	81349	FHN20G
A1A2XF2	SAME AS A1A2XF1		
A1A2 J1	CONNECTOR,RECEPTACLE,ELECTRICAL 9 MALE CONTACTS, 1 CONNECTOR MATING END. 550 V, 7.5 AMPS CURRENT RATING. ARC RESISTANT PLASTIC DIELECTRIC. STRAIGHT SHAPE. 1.213 IN. LG, 0.494 IN. W, 0.422 IN. H, O/A DIM,, EXCL CONTACTS. COPPER BASE SHELL. POLARIZED NONLOCKING. TWO 0.120 IN. DIA MTG HOLES SPACED 0.984 IN. C TO C. AMPHENOL-BORG PART NO. 17-91090	02660	17-91090

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A2	SPECTRUM DISPLAY, 20.3 TO 22.5 MC FREQ RANGE. 21.4 MC IF DISPLAY. 117 V, 60 CPS, SINGLE PHASE OPERATING POWER. 19.000 IN. LG, 6.312 IN. W, 8.719 IN. H, O/A DIM. PLUG-IN RACK MTG ASTRO COMMUNICATION LABORATORY PART NO. AD597-1	07397	02-8056/1-1
A2A1	CIRCUIT CARD ASSEMBLY, 33 CAPACITORS, 10 COILS, 1 PRINTED WIRING BOARD, 25 RESISTORS, 4 TRANSISTORS. 6.000 IN. LG, 2.250 IN. W, 0.750 IN. H O/A DIM. TWO 0.216 IN. DIA MTG HOLES SPACED 3.000 IN. C TO C. ASTRO COMMUNICATION LABORATORY PART NO. AC750-1	19905	AC750-1
A2A1C1	CAPACITOR,FIXED,MICA DIELECTRIC, 39 PF, PORM 5 PCT, 500 WVDC, SPEC NO. MIL-C-5	81349	CM05D390JN3
A2A1C2	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 7 PF, PORM 0.25 PF, 500 WVDC. SPEC NO. MIL-C-20	81349	CC20UJ070C
A2A1C3	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 68 PF, PORM 2 PCT, 500 WVDC, SPEC NO. MIL-C-20	81349	CC25SH680G
A2A1C4	SAME AS A2A1C3		
A2A1C5	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 6 PF, PORM 0.25 PF, 500 WVDC. SPEC NO. MIL-C-20	81349	CC20UJ060C
A2A1C6	SAME AS A2A1C3		
A2A1C7	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 5 PF, PORM 0.25 PF, 500 WVDC. SPEC NO. MIL-C-20	81349	CC20UJ050C
A2A1C8	SAME AS A2A1C3		
A2A1C9	SAME AS A2A1C5		
A2A1C10	SAME AS A2A1C3		
A2A1C11	SAME AS A2A1C2		
A2A1C12	SAME AS A2A1C3		
A2A1C13	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 1000 PF, PORM 20 PCT, 500 WVDC. SPEC NO. MIL-C-11015	81349	CK60AW102M

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A2A1C14	SAME AS A2A1C13		
A2A1C15	SAME AS A2A1C13		
A2A1C16	SAME AS A2A1C13		
A2A1C17	SAME AS A2A1C13		
A2A1C18	SAME AS A2A1C13		
A2A1C19	SAME AS A2A1C13		
A2A1C20	SAME AS A2A1C7		
A2A1C21	SAME AS A2A1C2		
A2A1C22	SAME AS A2A1C13		
A2A1C23	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 51 PF, PORM 2 PCT, 500 WVDC. SPEC NO. MIL-C-20	81349	CC20UJ510G
A2A1C24	SAME AS A2A1C13		
A2A1C25	SAME AS A2A1C13		
A2A1C26	SAME AS A2A1C13		
A2A1C27	SAME AS A2A1C13		
A2A1C28	SAME AS A2A1C13		
A2A1C29	SAME AS A2A1C7		
A2A1C30	SAME AS A2A1C7		
A2A1C31	SAME AS A2A1C2		
A2A1C32	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 33 PF, PORM 2 PCT, 500 WVDC. SPEC NO. MIL-C-20	81349	CC20UJ330G
A2A1C33	SAME AS A2A1C13		
A2A1L1	COIL,RADIO FREQUENCY, 1 SINGLE LAYER WINDING, 9 TURNS, NO. 27 AWG WIRE SIZE, 0.5 TO 1.1 UH INDUCTANCE RANGE, PLASTIC, HOLLOW COIL FORM, W/ADJUSTABLE POWDERED IRON CORE. METAL CASE, 0.435 IN. SQ BY 0.500 IN. H O/A DIM. 2 PIN TYPE TERMINALS. TWO 0.055 IN. BY 0.190 IN. MTG TABS. ASTRO COMMUNICATION LABORATORY PART NO. AC257-15-1	19905	AC257-15-1
A2A1L2	SAME AS A2A1L1		
A2A1L3	SAME AS A2A1L1		
A2A1L4	SAME AS A2A1L1		
A2A1L5	SAME AS A2A1L1		
A2A1L6	SAME AS A2A1L1		
A2A1L7	COIL,RADIO FREQUENCY, 1 SINGLE LAYER WINDING, 26 TURNS, NO. 38 AWG WIRE SIZE, 3.5 TO 8.8 UH INDUCTANCE RANGE, PLASTIC, HOLLOW COIL	19905	AC257-4-1

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	FORM, W/ADJUSTABLE POWDERED IRON CORE. METAL CASE, 0.435 IN. SQ BY 0.500 IN. H O/A DIM. 2 PIN TYPE TERMINALS. TWO 0.055 IN. BY 0.190 IN. MTG TABS. ASTRO COMMUNICATION LABORATORY PART NO. AC257-4-1		
A2A1L8	SAME AS A2A1L7		
A2A1L9	SAME AS A2A1L7		
A2A1L10	SAME AS A2A1L7		
A2A1Q1	TRANSISTOR, SILICON, NPN JUNCTION CONTACT CONSTRUCTION, 0.230 IN. DIA BY 0.210 IN. O/A DIM. HERMETICALLY SEALED, 4 WIRE LEAD TERMINALS. EIA NO. 2N3337	80131	2N3337
A2A1Q2	TRANSISTOR, SILICON, NPN JUNCTION CONTACT CONSTRUCTION, 0.230 IN. DIA BY 0.210 IN. O/A DIM. HERMETICALLY SEALED, 4 WIRE LEAD TERMINALS. ASTRO COMMUNICATION LABORATORY PART NO. SA395	19905	SA395
A2A1Q3	SAME AS A2A1Q1		
A2A1Q4	SAME AS A2A1Q2		
A2A1R1	RESISTOR,FIXED,COMPOSITION, 150 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF151J
A2A1R2	RESISTOR,FIXED,COMPOSITION, 33 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF330J
A2A1R3	SAME AS A2A1R1		
A2A1R4	RESISTOR,FIXED,COMPOSITION, 100 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF101J
A2A1R5	RESISTOR,FIXED,COMPOSITION, 10000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF103J
A2A1R6	RESISTOR,FIXED,COMPOSITION, 10 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF100J

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A2A1R7	RESISTOR,FIXED,COMPOSITION, 6800 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF682J
A2A1R8	RESISTOR,FIXED,COMPOSITION, 1500 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF152J
A2A1R9	SAME AS A2A1R7		
A2A1R10	RESISTOR,FIXED,COMPOSITION, 1000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF102J
A2A1R11	SAME AS A2A1R10		
A2A1R12	SAME AS A2A1R4		
A2A1R13	SAME AS A2A1R4		
A2A1R14	SAME AS A2A1R4		
A2A1R15	SAME AS A2A1R1		
A2A1R16	SAME AS A2A1R5		
A2A1R17	SAME AS A2A1R6		
A2A1R18	SAME AS A2A1R7		
A2A1R19	SAME AS A2A1R8		
A2A1R20	SAME AS A2A1R7		
A2A1R21	SAME AS A2A1R10		
A2A1R22	SAME AS A2A1R8		
A2A1R23	SAME AS A2A1R4		
A2A1R24	RESISTOR,FIXED,COMPOSITION, 68 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF680J
A2A1R25	SAME AS A2A1R4		
A2A2	CIRCUIT CARD ASSEMBLY, 46 CAPACITORS, 11 COILS, 7 CONNECTORS, 2 CRYSTALS, 2 FILTERS, 6 SEMICONDUCTOR DEVICE, DIODE, 1 PRINTED WIRING BOARD, 1 RELAY, 44 FIXED RESISTORS, 2 VARIABLE RESISTORS, 11 TRANSISTORS. 7.100 IN. LG, 3.000 IN. W, 1.000 IN. H O/A DIM. TWO 0.156 IN. DIA MTG HOLES SPACED 2.625 IN. C TO C. ASTRO COMMUNICATION LABORATORY PART NO. AC757-1	19905	AC757-1
A2A2C1	SAME AS A2A1C13		
A2A2C2	CAPACITOR,FIXED,CERAMIC DIELECTRIC 10000 PF, +80 -20 PCT, 1000 WVDC, SPEC NO. MIL-C-11015	81349	CK63AY103X

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A2A2C3	SAME AS A2A1C23		
A2A2C4	SAME AS A2A2C2		
A2A2C5	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 0.5 PF, PORM 0.25 PF, 500 WVDC. SPEC NO. MIL-C-20	81349	CC20CK0R5C
A2A2C6	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 39 PF, PORM 2 PCT, 500 WVDC. SPEC NO. MIL-C-20	81349	CC20UJ390G
A2A2C7	CAPACITOR,FIXED,MICA DIELECTRIC, 360 PF, PORM 5 PCT, 500 WVDC, SPEC NO. MIL-C-5	81349	CM15D361J03
A2A2C8	SAME AS A2A2C2		
A2A2C9	SAME AS A2A1C13		
A2A2C10	SAME AS A2A1C23		
A2A2C11	SAME AS A2A2C2		
A2A2C12	SAME AS A2A2C5		
A2A2C13	SAME AS A2A2C6		
A2A2C14	SAME AS A2A2C2		
A2A2C15	SAME AS A2A2C7		
A2A2C16	SAME AS A2A1C7		
A2A2C17	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 30 PF, PORM 2 PCT, 500 WVDC. SPEC NO. MIL-C-20	81349	CC20UJ300G
A2A2C18	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 100 PF, PORM 2 PCT, 500 WVDC. SPEC NO. MIL-C-20	81349	CC25UJ101G
A2A2C19	SAME AS A2A2C2		
A2A2C20	SAME AS A2A2C2		
A2A2C21	SAME AS A2A1C13		
A2A2C22	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 130 PF, PORM 2 PCT, 500 WVDC. SPEC NO. MIL-C-20	81349	CC25UJ131G
A2A2C24	CAPACITOR,FIXED,ELECTROLYTIC, 0.47 UF, PORM 20 PCT, 35 WVDC. SPEC NO. MIL-C-26655	81349	CS13AFR47M
A2A2C25	SAME AS A2A2C22		
A2A2C26	SAME AS A2A2C24		
A2A2C27	CAPACITOR,FIXED,ELECTROLYTIC, .1 UF, PORM 10 PCT, 100 WVDC,	81349	CS13BJ104K

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	SPEC NO. MIL-C-26655		
A2A2C28	SAME AS A2A2C2		
A2A2C29	SAME AS A2A2C27		
A2A2C30	SAME AS A2A2C2		
A2A2C31	SAME AS A2A2C27		
A2A2C32	SAME AS A2A1C2		
A2A2C33	SAME AS A2A1C13		
A2A2C34	SAME AS A2A1C13		
A2A2C35	SAME AS A2A2C18		
A2A2C36	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 200 PF, PORM 2 PCT, 500 WVDC, SPEC NO. MIL-C-20	81349	CC32UJ201G
A2A2C37	SAME AS A2A2C2		
A2A2C38	SAME AS A2A2C2		
A2A2C39	SAME AS A2A1C7		
A2A2C40	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 1 PF, PORM 0.25 PF, 500 WVDC, SPEC. NO. MIL-C-20	81349	CC20CK010C
A2A2C41	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 2 PF, PORM 0.25 PF, 500 WVDC, SPEC. NO. MIL-C-20	81349	CC20CK020C
A2A2C42	SAME AS A2A1C13		
A2A2C43	SAME AS A2A1C13		
A2A2C44	SAME AS A2A1C5		
A2A2C45	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 47 PF, PORM 2 PCT, 500 WVDC, SPEC NO. MIL-C-20	81349	CC20UJ470G
A2A2C46	CAPACITOR,FIXED,CERAMIC DIELECTRIC, 62 PF, PORM 2 PCT, 500 WVDC, SPEC NO. MIL-C-20	81349	CC20UJ620G
A2A2C47	SAME AS A2A1C13		
A2A2CR1	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N914
A2A2CR2	SAME AS A2A2CR1		
A2A2CR3	SAME AS A2A2CR1		
A2A2CR4	SAME AS A2A2CR1		
A2A2CR5	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N483B

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A2A3	CIRCUIT CARD ASSEMBLY, 1 CAPACITOR, 3 DIODE SEMICONDUCTOR DEVICES, 1 PRINTED WIRING BOARD, 14 FIXED RESISTORS, 4 VARIABLE RESISTORS. 3.500 IN. LG, 2.250 IN. W, 0.750 IN. H O/A DIM. TWO 0.216 IN. DIA MTG HOLES SPACED 3.000 IN. C TO C. ASTRO COMMUNICATION LABORATORY PART NO. AC756-1	19905	AC756-1
A2A3C1	SAME AS A2A1C13		
A2A3CR1	SEMICONDUCTOR DEVICE,DIODE SILICON. SPEC NO. MIL-S-19500	81349	JAN1N964B
A2A3CR2	SAME AS A2A3CR1		
A2A3CR3	SAME AS A2A3CR1		
A2A3R1	RESISTOR,FIXED,COMPOSITION, 680000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF684J
A2A3R2	RESISTOR,VARIABLE, 500000 OHMS, PORM 10 PCT, 1/4 W. SPEC NO. MIL-R-22097	81349	RJ12BP504
A2A3R3	RESISTOR,FIXED,COMPOSITION, 1 MEGOHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF105J
A2A3R4	SAME AS A2A3R3		
A2A3R5	RESISTOR,FIXED,COMPOSITION, 12000 OHMS, PORM 5 PCT, 1 W. SPEC NO. MIL-R-11	81349	RC32GF123J
A2A3R6	SAME AS A2A3R5		
A2A3R7	RESISTOR,FIXED,COMPOSITION, 470000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF474J
A2A3R8	RESISTOR,FIXED,COMPOSITION, 1.5 MEGOHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF155J
A2A3R9	SAME AS A2A3R7		
A2A3R10	RESISTOR,VARIABLE, 1 MEGOHM, PORM 10 PCT, 1/4 W.	81349	RJ12BP105

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	SPEC NO. MIL-R-22097		
A2A3R11	SAME AS A2A3R7		
A2A3R12	SAME AS A2A3R7		
A2A3R13	SAME AS A2A3R10		
A2A3R14	SAME AS A2A3R7		
A2A3R15	RESISTOR,FIXED,COMPOSITION, 330 OHMS, PORM 5 PCT, 1 W. SPEC NO. MIL-R-11	81349	RC32GF331J
A2A3R16	SAME AS A2A3R15		
A2A3R17	RESISTOR,FIXED,COMPOSITION, 47000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF473J
A2A3R18	RESISTOR,VARIABLE, 50000 OHMS, PORM 10 PCT, 1/4 W. SPEC NO. MIL-R-22097	81349	RJ12BP503
A2A4	CIRCUIT CARD ASSEMBLY, 10 CAPACITORS, 1 PRINTED WIRING BOARD, 18 FIXED RESISTORS, 3 VARIABLE RESISTORS, 6 TRANSISTORS. 3.500 IN. LG, 2.250 IN. W, 0.750 IN. H O/A DIM. TWO 0.216 IN. DIA MTG HOLES SPACED 3.000 IN. C TO C. ASTRO COMMUNICATION LABORATORY PART NO. AC746-1	19905	AC746-1
A2A4C1	CAPACITOR,FIXED,ELECTROLYTIC, 2.2 UF, PORM 10 PCT, 50 WVDC, SPEC NO. MIL-C-26655	81349	CS13AG2R2K
A2A4C2	SAME AS A2A4C1		
A2A4C3	SAME AS A2A4C1		
A2A4C4	SAME AS A2A4C1		
A2A4C5	CAPACITOR,FIXED,ELECTROLYTIC, 47 UF, PORM 10 PCT, 20 WVDC, SPEC NO. MIL-C-26655	81349	CS13AE470K
A2A4C6	SAME AS A2A4C5		
A2A4C7	SAME AS A2A4C1		
A2A4C8	SAME AS A2A4C1		
A2A4C9	CAPACITOR,FIXED,ELECTROLYTIC, 1 UF, PORM 10 PCT, 50 WVDC, SPEC NO. MIL-C-26655	81349	CS13AG010K

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A2A4C10	SAME AS A2A4C9		
A2A4Q1	SAME AS A1A1A1Q12		
A2A4Q2	TRANSISTOR, SILICON, PNP JUNCTION CONTACT CONSTRUCTION. 0.365 IN. DIA BY 0.260 IN. H O/A DIM. 1 CASE. 3 PIN TERMINAL. EIA NO. 2N491	80131	2N491
A2A4Q3	TRANSISTOR, SILICON. NPN JUNCTION CONTACT CONSTRUCTION. SPEC NO. MIL-S-19500	81349	JAN2N1613
A2A4Q4	SAME AS A2A4Q3		
A2A4Q5	TRANSISTOR, SILICON, NPN JUNCTION CONTACT CONSTRUCTION, 0.370 IN. DIA BY 0.260 IN. H O/A DIM. HERMETICALLY SEALED. 3 WIRE LEAD TERMINALS. EIA NO. 2N3114	80131	2N3114
A2A4Q6	SAME AS A2A4Q5		
A2A4R1	RESISTOR,FIXED,COMPOSITION, 5600 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF562J
A2A4R2	RESISTOR, VARIABLE WIRE WOUND. 1 SECTION, 1000 OHMS,PORM 5 PCT. 0.50 W. 3 PIN TYPE TERMINALS INCLOSED, 0.312 IN. DIA BY 0.187 THK O/A DIM. SINGLE RD SLOTTED METAL SHAFT. MTG FACILITIES NOT INCLUDED. BOURNS INC. 3300P1-102	80294	3300P1-102
A2A4R3	RESISTOR,FIXED,COMPOSITION, 15000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF153J
A2A4R4	SAME AS A2A1R8		
A2A4R5	RESISTOR,FIXED,COMPOSITION, 22000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF223J
A2A4R6	RESISTOR,VARIABLE, COMPOSITION, SLIDING BRUSH TYPE, 100000 OHMS, PORM 20 PCT, STD A TAPER, THREE PIN TYPE TERMINALS. INCLOSED, 0.312 IN. DIA BY 0.171 IN. H. SINGLE	80294	3301P1-104

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	SLOTTED METAL SHAFT, 0.220 IN. DIA BY 0.062 IN. LG, MTG FACILITIES NOT INCLUDED. BOURNS LABS INC. PART NO. 3301P1-104		
A2A4R7	SAME AS A2A1R7		
A2A4R8	RESISTOR,FIXED,COMPOSITION, 3300 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF332J
A2A4R9	SAME AS A2A4R8		
A2A4R10	SAME AS A2A1R5		
A2A4R11	SAME AS A2A3R1		
A2A4R12	SAME AS A2A3R1		
A2A4R13	SAME AS A2A1R5		
A2A4R14	RESISTOR,FIXED,COMPOSITION, 1200 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF122J
A2A4R15	SAME AS A2A3R17		
A2A4R16	SAME AS A2A3R17		
A2A4R17	SAME AS A2A4R14		
A2A4R18	SAME AS A2A3R3		
A2A4R19	SAME AS A2A3R3		
A2A4R20	RESISTOR,VARIABLE, COMPOSITION ELEMENT, 1 SECT, 1 MEGOHM, PORM 20 PCT, 0.25 W, 3 PIN TYPE TERMINALS, INCLOSED, 0.312 IN. DIA BY 0.187 IN. THK, O/A DIM, SINGLE RD SLOTTED METAL SHAFT, TERMINAL MTD. BOURNS INC. PART NO. 3301P1-105	80294	3301P1-105
A2A4R21	SAME AS A2A3R3		
A2C1	CAPACITOR,FIXED,MICA DIELECTRIC, 1 SECTION, 500 WVDC, 1000 PF, PORM 2 PCT, METAL CASE, 0.505 IN. DIA BY 0.692 IN. LG, 2 SOLDER LUG TERMINALS. SPEC NO. MIL-C-10950	81349	M10950-9-0046
A2C2	SAME AS A2C1		
A2C3	SAME AS A2C1		
A2C4	SAME AS A2C1		
A2C5	SAME AS A2C1		
A2C6	SAME AS A2C1		

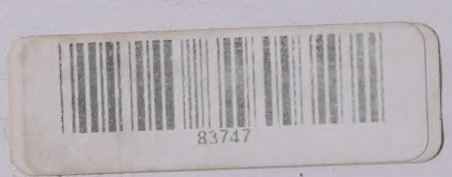
REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A2C7	CAPACITOR,FIXED,PAPER DIELECTRIC, TWO SECTIONS, 0.5 UF EACH SECTION, +20 -10, 1000 WVDC, SPEC NO. MIL-C-25	81349	CP5484FG504V1
A2C8	CAPACITOR,FIXED,MICA DIELECTRIC, 330 PF, PORM 5 PCT, >00 WVDC, SPEC NO. MIL-C-5	81349	CM15D331J03
A2C9	CAPACITOR,FIXED,ELECTROLYTIC, 2.2 UF, PORM 10 PCT, 50 WVDC, SPEC NO. MIL-C-26655	81349	CS13BG225K
A2C10	CAPACITOR,FIXED,ELECTROLYTIC, 15 UF, PORM 10 PCT, 20 WVDC, SPEC NO. MIL-C-26655	81349	CS13BE156K
A2C11	SAME AS A2A1C13		
A2C12	SAME AS A2A1C13		
A2C13	SAME AS A2A1C13		
A2C14	SAME AS A2A1C13		
A2C15	SAME AS A2A1C13		
A2C16	SAME AS A2A1C13		
A2C17	SAME AS A2A1C13		
A2C18	SAME AS A2A1C13		
A2CR1	SEMICONDUCTOR DEVICE,DIODE, SILICON. SPEC NO. MIL-S-19500	81349	JAN1N1731A
A2CR2	SAME AS A2CR1		
A2CR3	SAME AS A2A2CR1		
A2CR4	SAME AS A2A2CR1		
A2CR5	SAME AS A2A2CR1		
A2CR6	SAME AS A2A2CR1		
A2CR7	SAME AS A2A2CR1		
A2CR8	SAME AS A2A2CR1		
A2E26	CONTACT,ELECTRICAL, GOLD-PLATED OVER SILVER-PLATED BRASS CONTACTS, 0.734 IN. LG, 0.648 IN. W, 0.218 IN. H, 1 KV AC. ONE RIGHT ANGLE SOLDER CUP TERMINAL LOCATED AT ONE END. ITT CANNON ELECTRIC INC PART NO. DM53741-5000	71468	DM53741-5000
A2E27	SAME AS A2E26		
A2E28	SAME AS A2E26		
A2E29	SAME AS A2E26		
A2E30	SAME AS A2E26		
A2E31	SAME AS A2E26		
A2E32	SAME AS A2E26		

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A2L1	COIL,RADIO FREQUENCY, 12.00 UH, PORM 10 PCT, 36 MC SELF-RESONANT FREQUENCY. SPEC NO. MIL-C-15305	81349	LT4K047
A2L2	SAME AS A2L1		
A2L3	SAME AS A2L1		
A2MP1	PACKING,PREFORMED, SYNTHETIC RUBBER, AMS-7271. RD CROSS-SECTION. 3.222 IN. MIN, 3.252 IN. MAX ID, 0.100 IN. MIN, 0.106 IN. MAX O/A H. MINNESOTA RUBBER PART NO. 8152	07322	8152
A2MP2	BOOT,DUST AND MOISTURE SEAL, SILICONE RUBBER, TYPE C, SIZE 4. SPEC NO. MIL-B-5423	81349	MILB5423-9SIZE4
A2MP3	SAME AS A2MP2		
A2MP4	SAME AS A2MP2		
A2MP5	SAME AS A2MP2		
A2MP6	BOOT,DUST AND MOISTURE SEAL SILICONE RUBBER, TYPE A, STYLE 7, SIZE 1. SPEC NO. MIL-B-5423	81349	MILB5423-5SIZE1
A2MP7	SCALE,CATHODE RAY TUBE, 1 HORIZONTAL SCALE, 10 GRADUATIONS. 1 VERTICAL SCALE, 4 GRADUATIONS. PLASTIC. 2.859 IN. LG, 1.234 IN. W, 0.062 IN. THK O/A DIM. ASTRO COMMUNICATION LABORATORY PART NO. B963	19905	B963
A2P1	CONNECTOR,RECEPTACLE,ELECTRICAL, 17 MALE CONTACTS, 1 CONNECTOR MATING END, 7.5 AMPS, 550 VDC. ARC RESISTANT PLASTIC DIELECTRIC. STRAIGHT SHAPE. 2.729 IN. LG BY 0.494 IN. W BY 0.426 IN. H, O/A DIM. W/INCLOSING STEEL SHELL, CORROSION RESISTANT. POLARIZED, NONLOCKING TYPE. TWO 0.120 IN. DIA MTG HOLES SPACED 2.500 IN. C TO C. ITT CANNON ELECTRIC PART NO. DCM17W5PNMB	71468	DCM17W5PNMB
A2P2	SAME AS A2P1		
A2P3	CLIP,ELECTRICAL, GRID PLATE TYPE. ACCOMMODATES 0.096 IN. DIA MATERIAL. CADMIUM-PLATED COPPER ALLOY. UNINSULATED. 0.250 IN.	19905	B1100

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	H, 0.900 IN. LG. 1 SOLDER LUG TERMINAL, ASTRO COMMUNICATION LABORATORY PART NO. 81100		
A2P4	PLUG,TIP, 0.025 IN. DIA TIP CONTACT ELEMENT. PLASTIC INSULATION, STRAIGHT TYPE, RED. PRECIOUS METAL PLATED PIN, SOLDERLESS TYPE WIRE ATTACHMENT. 0.312 IN. LG O/A. CAMBRIDGE THERMIONIC CORP. PART NO. 3102-1-0312	71279	3102-1-0312
A2P5	SAME AS A2P4		
A2R1	RESISTOR,VARIABLE, 10000 OHMS, PORM 10 PCT, 1/2 W. SPEC NO. MIL-R-94	81349	RV6NAYSD103A
A2R2	RESISTOR,FIXED,COMPOSITION, 3900 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF392J
A2R3	RESISTOR,FIXED,COMPOSITION, 4700 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF472J
A2R4	RESISTOR,FIXED,COMPOSITION, 33000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF333J
A2R5	RESISTOR,FIXED,COMPOSITION, 56000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF563J
A2R6	RESISTOR,FIXED,COMPOSITION, 120000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF124J
A2R7	RESISTOR,FIXED,COMPOSITION, 330000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF334J
A2R8	RESISTOR,FIXED,COMPOSITION, 100000 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF104J
A2R9	SAME AS A2R8		
A2R10	RESISTOR,VARIABLE, 1000 OHMS, PORM 10 PCT, 1/2 W	81349	RV6NAYSD102A

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
	SPEC NO. MIL-R-94		
A2R11	RESISTOR,FIXED,COMPOSITION, 2700 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF272J
A2R12	RESISTOR,FIXED,COMPOSITION, 470 OHMS, PORM 5 PCT, 1/4 W. SPEC NO. MIL-R-11	81349	RC07GF471J
A2R13	SAME AS A2R12		
A2R14	SAME AS A2R12		
A2R15	SAME AS A2R12		
A2R16	SAME AS A2R12		
A2R17	SAME AS A2R12		
A2R18	SAME AS A2R12		
A2R19	SAME AS A2A1R5		
A2S1	SWITCH,ROTARY, 2 SECT, 6 POS MAX, 30 DEG INCREMENT, 2P6T, 2 MOVING RHODIUM-PLATED MOVING AND 14 FIXED SILVER ALLOY, NONSHORTING CONTACTS, 115 VAC, 28 VDC, 1/4 AMP. PLASTIC HOUSING AND INSULATION, 0.610 IN. DIA, 1.125 IN. LG, 1/4-32 THD MTG BUSHING, 1/4 IN. LG, 1/8 IN. DIA SHAFT, 0.593 IN. LG. SOLDER LUG TERMINALS. RCL ELECTRONICS PART NO. SW134	01686	SW134
A2S2	SWITCH,ROTARY, 2 SECT, 5 POS MAX, 30 DEG. 4 MOVING RHODIUM-PLATED COPPER AND 28 FIXED SILVER CONTACTS, NONSHORTING, 4P5T. 115 VAC, 28 VDC, 1/4 AMP. PLASTIC INSULATION AND HOUSING. 0.610 IN. DIA, 1.093 IN. DEEP. 1/8 IN. DIA SHAFT, 0.590 IN. LG, LUG TERMINALS. 1/4-32 THD MTG BUSHING, 1/4 IN. LG, ASTRO COMMUNICATION PART NO. A901	19905	A901
A2S3	SWITCH,TOGGLE, SPDT, RDG 217, AC,DC. 30 VOLTS 5 AMPS DC, 115 VOLTS 5 AMPS AC. 0.406 IN. LG BY 0.275 IN. W BY 0.525 IN. H O/A DIM. BAT TYPE ACTUATOR, 0.547 IN. LG. 3 SOLDER LUG TYPE TERMINALS. 0.375 IN. LG BY 1/4-40 THD, BUSHING MTD. MIL STD PART NO. MS75028-22	96906	MS75028-22

REFERENCE SYMBOL	NAME AND DESCRIPTION	FSMC	PART NUMBER
A2T1	TRANSFORMER,POWER STEP DOWN + STEP UP, FULLY INCLOSED, PLASTIC CASE W/BROWN EPOXY. 115 V. SINGLE PHASE. 2.350 IN. H, 2.120 IN. W BODY DIM. 10 SOLDER LUG TYPE TERMINALS. FOUR 0.156 IN. BY 0.281 IN. SLOT MTD. SPACED ON 1.620 IN. BY 1.500 IN. C TO C. BALTIMORE TRANSFORMER AND COIL PART NO. BX3760	85323	BX3760
A2V1	ELECTRON TUBE, GLASS ENVELOPE. CATHODE RAY. EIA NO. 3ASP1. SYLVANIA ELECTRONIC TUBE DIV PART NO. 3ASP1	82219	3ASP1
A2VR1	ELECTRON TUBE, GLASS ENVELOPE, COROTRON, 1200 V, PORM 18 V. VICTOREEN PART NO. GV3A1200	63060	GV3A1200
A2XA1	CONNECTOR,RECEPTACLE,ELECTRICAL, 16 CONTACTS, 1 MATING END, ARC RESISTANT PLASTIC DIELECTRIC, STRAIGHT SHAPE, 3.950 IN. LG BY 0.453 IN. W BY 0.453 IN. H O/A DIM, POLARIZED, 2 MTG HOLES, 0.128 IN. DIA, ELCO CORP PART NO. 00-5009-016-146-001	91662	00-5009-016-146-001
A2XA2	CONNECTOR,RECEPTACLE,ELECTRICAL, 12 CONTACTS, 1 MATING END, ARC RESISTANT PLASTIC DIELECTRIC, STRAIGHT SHAPE, 3.150 IN. LG BY 0.453 IN. W BY 0.453 IN. H O/A DIM, POLORIZED, 2 MTG HOLES, 0.128 IN. DIA, ELCO CORP PART NO. 00-5009-012-146-001	91662	00-5009-012-146-001
A2XA3	SAME AS A2XA1		
A2XA4	SAME AS A2XA2		
A2XV1	SOCKET,ELECTRON TUBE, 8 PIN HOT TIN DIP BRASS CONTACTS, PLASTIC BODY, 1.250 IN. DIA BY 0.380 IN. H, 8 SOLDER TAB TYPE CONTACT TERMINALS. TWO 0.078 IN. DIA HOLES SPACED 0.875 B.C. SYLVANIA ELECTRON TUBE DIVISION PART NO. 7550-0026	94151	7550-0026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